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FROM THE

UNITED STATES GOVERNMENT

H. O. No. 135

NORTH SEA PILOT

(EASTERN SHORES)

FROM

DUNKERQUE TO THE SKAW

1918

SECOND EDITION

PUBLISHED BY THE HYDROGRAPHIC OFFICE
UNDER THE AUTHORITY OF THE
SECRETARY OF THE NAVY

WASHINGTON
GOVERNMENT PRINTING OFFICE
1918

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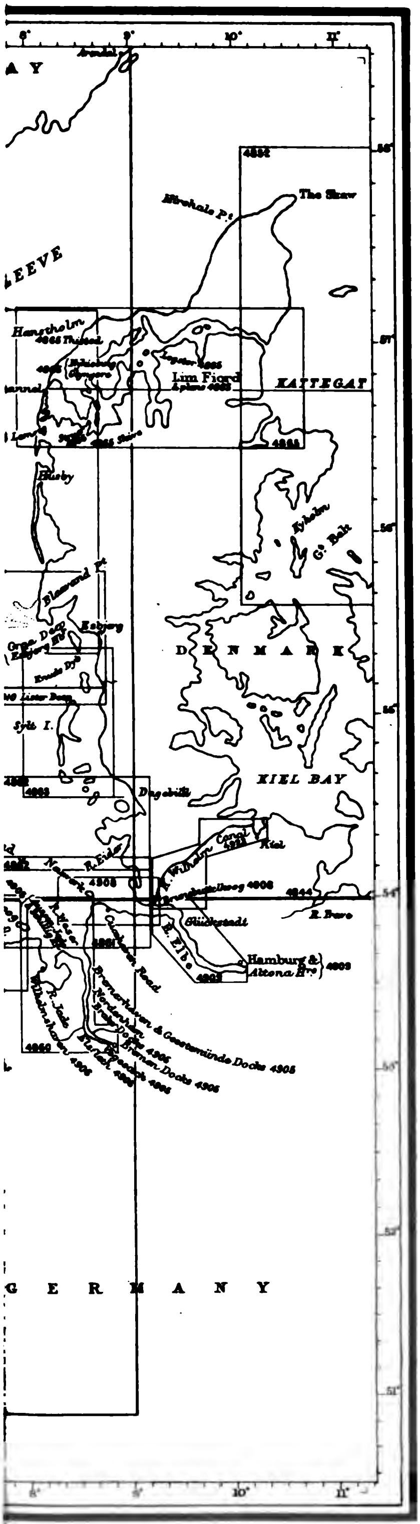
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PREFACE.

This publication, a revision of the first edition of H. O. 135, comprises descriptions of, and sailing directions for, the eastern shores of the North Sea, from Dunkerque to the Skaw.

The work contains the latest available information from reliable sources and is corrected to May 1, 1918.

The bearings and courses are true and are given in degrees, from 0° (north) to 360° (clockwise).

Bearings limiting sectors of lights are toward the light.

The directions of winds refer to the points from which they blow; of currents, the points toward which they set. These directions are true.

Variations, with the annual rate of change, may be obtained from H. O. chart No. 2406, Variation of the Compass.

Distances are expressed in nautical miles, the mile being approximately 2,000 yards.

Soundings are referred to low water ordinary springs.

Heights are referred to high water spring tides.

For details of lights, fog signals, submarine bells, and light buoys, mariners should consult H. O. No. 34, List of Lights, Vol. V. Light Lists are published annually while Sailing Directions can usually only be republished once in a number of years.

Summary of Notices to Mariners.—While it is the intention of the Hydrographic Office to publish about the first of each year a Summary of Notices to Mariners of the preceding year, affecting volumes of Sailing Directions, it must be understood that these summaries are intended to include only important changes and corrections and that their publication may be discontinued at any time, especially when a new edition of a volume is issued.

No attempt has been made to include in this volume war and mine zone limits, or the special and temporary changes in harbor traffic, and pilot regulations, lights, and buoyage, due to the abnormal conditions brought about by the present war.

Masters of vessels should keep complete files of weekly Notices to Mariners and supply themselves with the latest List of Lights and seek from local authorities, pilots, and harbor masters the latest information relative to any special regulations in force in the particular locality visited, and must be governed by any orders given them by national patrol boats, no matter what harbor of any of the warring nations they may be approaching or entering.

Mariners are requested to notify the U. S. Hydrographic Office, Washington, D. C., or one of its branch offices, of errors they may discover in this publication, or of additional matter which they think should be inserted.

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INFORMATION RELATING TO NAVIGATIONAL AIDS AND GENERAL NAVIGATION.

THE CORRECTION OF CHARTS, LIGHT LISTS, AND SAILING DIRECTIONS.

The following publications are issued by the United States Hydrographic Office as guides to navigation: Charts, Chart Catalogues, Sailing Directions, Light Lists, Tide Tables, Notices to Mariners, Pilot Charts, and Hydrographic Bulletins. Of these, the Notices to Mariners and the Hydrographic Bulletins are free to mariners and others interested in shipping. The Pilot Charts are free to contributors of professional information, but are sold to the general public at 10 cents a copy. The other publications of the office are sold under the law at cost price.

The Charts, the Sailing Directions, and the Light Lists are all affected by continual changes and alterations, concerning which information from all parts of the world is published weekly in the Notices to Mariners.

The charts are always corrected for all available information up to the date of issue stamped upon them; and the Light Lists should be noted for the recent alterations and additions. The Sailing Directions, however, can not, from their nature, be so fully corrected, and in all cases where they differ from the charts, the charts must be taken as the guide.

Charts.—When issued from the Hydrographic Office, the charts have received all necessary corrections to date.

All small but important corrections that can be made by hand are given in the Notices to Mariners, and should at once be placed on the charts to which they refer.

Extensive corrections that can not be conveniently thus made are put upon the plates, and new copies are put on sale. Masters of vessels are urged to replace the old charts, which should be destroyed to prevent the possibility of their being used in the navigation of the ship.

The dates on which extensive corrections are made are noted on the chart on the right of the middle of the lower edge; those of the smaller corrections at the left lower corners.

The edition, and corresponding date, of the chart will be found in the right lower corner, outside the outer neat line.

In all cases of quotations of charts, these dates of corrections should be given, as well as the number of the chart (found in the lower right and upper left corners), in order that the edition of the chart referred to may be known.

The Light Lists are corrected before issue, and all changes are published in the weekly Notices to Mariners.

The navigating officer should make notations in the tabular form in the Light Lists and paste in at the appropriate places slips from the Notices to Mariners.

The Light Lists should always be consulted as to the details of a light, as the description in the sailing directions is not complete, and may be obsolete, in consequence of changes since publication.

The Sailing Directions or Pilots are kept corrected by addenda; and subsequent to date of last addenda, they should be kept corrected by means of the Notices to Mariners. Sailing Directions issued to naval vessels carry with them an envelope containing slips of corrections up to date of issue.

Addenda are published from time to time, and contain a summary of all the information received up to date since the publication of the volume to which they refer, canceling all previous Notices to Mariners.

To enable the books to be more conveniently corrected, addenda and Notices to Mariners are printed on one side only, and two copies of the latter are issued to each naval vessel, one to be cut and the slips pasted in at the appropriate places, the other to be retained intact for reference.

To paste in the slips, as the Notices to Mariners are received, is one of the duties of the navigating officer, demanding faithful attention.

It must, however, be understood that Sailing Directions will rarely be correct in all details, and that, as already stated, when differences exist, the chart, which should be corrected from the most recent information, should be taken as the guide, for which purpose, for ordinary navigation, it is sufficient.

The Tide Tables, which are published annually by the United States Coast and Geodetic Survey, give the predicted times and heights of the high and the low waters for every day in the year at 70 of the principal ports of the world, and, through the medium of these by means of tidal differences and ratios, at a very large number of subordinate ports. The tables for the Atlantic and the Pacific coast ports of the United States are also published separately.

It should be remembered that these tables aim to give the times of high and low water, and not the times of turning of the current or of slack water, which may be quite different.

Notices to Mariners, containing newly acquired information pertaining to various parts of the world, are published weekly and mailed to all United States ships in commission, Branch Hydrographic offices and agencies, and United States consulates. Copies are furnished free by the main office or by any of the branch offices on application.

With each Notice to naval vessels is sent also a separate sheet, giving the items relating to lights contained in the latest Notice, intended especially for use in correcting the Light Lists.

Pilot Charts of the North Atlantic, Central American Waters, and North Pacific and Indian Oceans are published each month, and of the South Atlantic and South Pacific Oceans each quarter. These charts give the average conditions of wind and weather, barometer, percentage of fog and gales, routes for steam and sailing vessels for the period of issue, ice, and derelicts for the preceding period, ocean currents and magnetic variation for the current year, storm tracks for preceding years, and much other useful information. They are furnished free only in exchange for marine data or observations.

Hydrographic Bulletins, published weekly, are supplements to the Pilot Charts, and contain the latest reports of obstructions and dangers along the coast and principal ocean routes, ice, derelicts, and wreckage, reports of the use of oil to calm the sea, and other information for mariners. They are to be had free upon application.

THE USE OF CHARTS.

Accuracy of chart.—The value of a chart must manifestly depend upon the character and accuracy of the survey on which it is based, and the larger the scale of the chart the more important do these become.

To judge of a survey, its source and date, which are generally given in the title, are a good guide. Besides the changes that may have taken place since the date of the survey, in waters where sand or mud prevails, the earlier surveys were mostly made under circumstances that precluded great accuracy of detail; until a chart founded on such a survey is tested, it should be regarded with caution. It may, indeed, be said that, except in well-frequented harbors and their approaches, no surveys yet made have been so thorough as to make it certain that all dangers have been found. The number of the soundings is another method of estimating the completeness of the survey, remembering, however, that the chart is not expected to show all the soundings that were obtained. When the soundings are sparse or unevenly distributed, it may be taken for granted that the survey was not in great detail.

Large or irregular blank spaces among soundings mean that no soundings were obtained in these spots. When the surrounding soundings are deep it may fairly be assumed that in the blanks the water is also deep; but when they are shallow, or it can be seen from the rest of the chart that reefs or banks are present, such blanks should be regarded with suspicion. This is especially the case in coral regions and off rocky coasts, and it should be remembered that in waters where rocks abound it is always possible that a survey, however complete and detailed, may have failed to find every small patch or pinnacle rock.

A wide berth should therefore be given to every rocky shore or patch, and instead of considering a coast to be clear, the contrary should be assumed.

Fathom curves a caution.—Except in charts of harbors that have been surveyed in detail, the 5-fathom curve on most charts may be considered as a danger line or caution against unnecessarily approaching the shore or bank within that line, on account of the possible existence of undiscovered inequalities of the bottom, which only an elaborate detailed survey could reveal. In general surveys of coasts or of little frequented anchorages, the necessities of navigation do not demand the great expenditure of time required for so detailed a survey. It is not contemplated that ships will approach the shores in such localities without taking special precautions.

The 10-fathom curve on rocky shores is another warning, especially for ships of heavy draft.

A useful danger curve will be obtained by tracing out with a colored pencil, or ink, the line of depth next greater than the draft of the ship using the chart. For vessels drawing less than 18 feet the edge of the sanding serves as a well-marked danger line.

Charts on which no fathom curves are marked must especially be regarded with caution, as indicating that soundings were too scanty and the bottom too uneven to enable the curves to be drawn with accuracy.

Isolated soundings, shoaler than surrounding depths, should always be avoided, especially if ringed around, as it is doubtful how closely the spot may have been examined and whether the least depth has been found.

The chart on largest scale should always be used on account of its greater detail and the greater accuracy with which positions may be plotted on it.

Caution in using small-scale charts.—In approaching the land or dangerous banks, regard must always be had to the scale of the chart used. A small error in laying down a position means only yards on a large-scale chart, whereas on one of small scale the same amount of displacement means a large fraction of a mile.

Distortion of printed charts.—The paper on which charts are printed from engraved plates has to be damped. On drying distortion takes place from the inequalities of the paper, which greatly varies with different papers and the amount of the damping; but it does not affect navigation. The larger the chart the greater the amount of this distortion. It must not, however, be expected that accurate series of angles taken to different points will always exactly agree when carefully plotted on the chart, especially if the lines to objects be long.

Mercator chart.—Observed bearings are not identical with those measured on the Mercator chart (excepting only the bearings north and south, and east and west on the Equator) because the line of sight, except as affected by refraction, is a straight line and lies in the plane of the great circle, while the straight line on the chart (except the meridian line) represents, not the arc of a great circle, but the loxodromic curve, or rhumb line, which on the globe is a spiral approaching but never in theory reaching the pole, or, if the direction be east and west, a circle of latitude.

The difference is not appreciable with near objects, and in ordinary navigation may be neglected. But in high latitudes, when the objects are very distant and especially when lying near east or west, the bearings must be corrected for the convergence of the meridians in order to be accurately placed on the Mercator chart, which represents the meridians as parallel.

On the polyconic chart, since a straight line represents (within the limits of 15 or 20 degrees of longitude) the arc of a great circle or the shortest distance between two points, bearings of the chart are identical with observed bearings.

The Mercator projection is unsuited to surveying, for which purpose the polyconic projection is used by the Hydrographic Office and the Coast and Geodetic Survey.

Notes on charts should always be read with care, as they may give important information that can not be graphically represented.

Buoys.—Too much reliance should not be placed on buoys always maintaining their exact positions. They should therefore be regarded as warnings, and not as infallible navigational marks, especially when in exposed places and in the winter time, and a ship's position should always, when possible, be checked by bearings or angles of fixed objects on shore.

Gas buoys.—The lights shown by gas buoys can not be implicitly relied on; the light may be altogether extinguished, or, if periodic, the apparatus may get out of order.

Whistle and bell buoys are sounded only by the action of the sea; therefore, in calm weather, they are less effective or may not sound.

Lights.—All the distances given in the Light Lists and on the charts for the visibility of lights are calculated for a height of 15 feet for the observer's eye. The effect of a greater or less height of eye can be ascertained by means of the table of distances of visibility due to height, published in the Light Lists.

The glare of a powerful light is often seen far beyond the limit of visibility of the actual rays of the light, but this must not be confounded with the true range. Refraction, too, may often cause a light to be seen farther than under ordinary circumstances.

When looking out for a light, the fact may be forgotten that aloft the range of vision is much increased. By noting a star immediately over the light a very correct bearing may be obtained from the standard compass when you lay down from aloft.

On first making a light from the bridge, by at once lowering the eye several feet and noting whether the light is made to dip, it may be determined whether the ship is on the circle of visibility corresponding with the usual height of the eye, or unexpectedly nearer the light.

The intrinsic power of a light should always be considered when expecting to make it in thick weather. A weak light is easily obscured by haze, and no dependence can be placed on its being seen.

The power of a light can be estimated by its candlepower or order, as stated in the Light Lists, and in some cases by noting how much its visibility in clear weather falls short of the range corresponding to its height. Thus, a light standing 200 feet above the sea and recorded as visible only 10 miles in clear weather, is manifestly of little brilliancy, as its height would permit it to be seen over 20 miles if of sufficient power.

Fog signals.—Sound is conveyed in a very capricious way through the atmosphere. Apart from the influence of the wind large areas of silence have been found in different directions and at different distances from the origin of sound, even in clear weather; therefore, too much confidence should not be felt as to hearing a fog signal. The apparatus, moreover, for sounding the signal often requires some time before it is in readiness to act. A fog often creeps imperceptibly toward the land, and may not be observed by the lighthouse keepers until upon them; a ship may have been for many hours in it, and approaching the land in confidence, depending on the signal, which is not sounded. When sound travels against the wind, it may be thrown upward; a man aloft might then hear it though inaudible on deck.

The submarine bell system of fog signals is much more reliable than systems transmitting sound through the air, as sound traveling in water is not subject to the same disturbing influences; the fallibility of the lighthouse keeper is, however, about the same in all systems, so that caution should be observed even by vessels equipped with submarine-bell receiving apparatus.

Submarine bells have an effective range of audibility greater than signals sounded in air, and a vessel equipped with receiving apparatus may determine the approximate bearing of the signal. These signals may be heard also on vessels not equipped with receiving apparatus by observers below the water line, but the bearing of the signal can not then be readily determined.

Vessels equipped with radio apparatus and submarine bell receivers may fix their distance from a light vessel having radio and submarine bell, utilizing the difference in velocity of sound waves of the radio and the bell. Sound travels 4,794 feet per second at 66° F. in water, and the travel of radio sound waves for practicable distances may be taken as instantaneous.

All vessels should observe the utmost caution in closing the land in fogs. The lead is the safest guide and should be faithfully used.

Tides.—A knowledge of the times of high and low water and of the amount of vertical rise and fall of the tide is of great importance in the case of vessels entering or leaving port, especially when the low water is less than or near their draft. Such knowledge is also useful at times to vessels running close along a coast, in enabling them to anticipate the effect of the tidal currents in setting them on or offshore. This is especially important in fog or thick weather.

The predicted times and heights of the high and low waters, or differences by which they may be readily obtained, are given in the Tide Tables for all the important ports of the world. The height at any intermediate time may be obtained by means of Table 3 for most of the principal tidal stations of the United States, given in Table 1, and for the subordinate stations of Table 2 by using them as directed in the Tide Tables. The intermediate height may also be obtained by plotting the predicted times and heights of high and low water and connecting the points by a curve. Such knowledge is often useful in crossing a bar or shallow flats.

Planes of reference.[1]—The plane of reference for soundings on Hydrographic Office charts made from United States Government surveys and on Coast and Geodetic Survey charts of the Atlantic coast of the United States is mean low water; on the Pacific coast of the United States as far as the Strait of Juan Fuca, it is the mean of the lower low waters; and from Puget Sound to Alaska, the plane employed on Hydrographic Office charts is low water ordinary springs.

On most of the British Admiralty charts the plane of reference is the low water of ordinary springs; on French charts, the low water of equinoctial springs.

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[1] The distinction between "rise" and "range" of the tide should be understood. The former expression refers to the height attained above the datum plane or soundings, differing with the different planes of reference; the latter, to the difference of level between successive high and low waters.

In the case of many charts compiled from old or various sources the plane of reference may be in doubt. In such cases, or whenever not stated on the chart, the assumption that the reference plane is low water ordinary springs gives a larger margin of safety than mean low water.

Whichever plane of reference may be used for a chart it must be remembered that there are times when the tide falls below it. Low water is lower than mean low water about half the time, and when a new or full moon occurs at perigee the low water is lower than the average low water of springs. At the equinoxes the spring range is also increased on the coasts of Europe, but in some other parts of the world, and especially in the Tropics, such periodic low tides may coincide more frequently with the solstices.

Wind or a high barometer may at times cause the water to fall below even a very low plane of reference.

On coasts where there is much diurnal inequality in the tides, the amount of rise and fall can not be depended upon and additional caution is necessary.

Mean sea level.—The important fact should be remembered that the depths at half tide are practically the same for all tides, whether neaps or springs. Half tide therefore corresponds with mean sea level. This makes a very exact plane of reference, easily found, to which it would be well to refer all high and low waters.

The Tide Tables give in Table 1, for all the ports, the plane of reference to which tidal heights are referred and its distance below mean sea level. See also explanation of Table 2.

If called on to take special soundings for the chart at a place where there is no tidal bench mark, mean sea level should be found and the plane for reductions established at the proper distance below it, as ascertained by the Tide Tables, or by observations, or in some cases, if the time be short, by estimation, the data used being made a part of the record.

Tidal streams.—In navigating coasts where the tidal range is considerable, especial caution is necessary. It should be remembered that there are indrafts to all bays and bights, although the general run of the stream may be parallel with the shore.

The turn of the tidal stream offshore is seldom coincident with the times of high and low water on the shore. In some channels the tidal stream may overrun the turn of the vertical movement of the tide by three hours, forming what is usually known as tide and half tide, the effect of which is that at high and low water by the shore the stream is running at its greatest velocity.

The effect of the tidal wave in causing currents may be illustrated by two simple cases.

(1) Where there is a small tidal basin connected with the sea by a large opening.

(2) Where there is a large tidal basin connected with the sea by a small opening.

In the first case the velocity of the current in the opening will have its maximum value when the height of the tide within is changing most rapidly, i. e., at a time about midway between high and low water. The water in the basin keeps at approximately the same level as the water outside. The flood stream corresponds with the rising and the ebb with the falling of the tide.

In the second case the velocity of the current in the opening will have its maximum value when it is high water or low water without, for then there is the greatest head of water for producing motion. The flood stream begins about three hours after low water, and the ebb stream about three hours after high water, slack water thus occurring about midway between the tides.

Along most shores not much affected by bays, tidal rivers, etc., the current usually turns soon after high water and low water.

The swiftest current in straight portions of tidal rivers is usually in the middle of the stream, but in curved portions the most rapid current is toward the outer edge of the curve, and here the water will be deepest. The pilot rule for best water is to follow the ebb tide reaches.

Countercurrents and eddies may occur near the shores of straits, especially in bights and near points. A knowledge of them is useful in order that they may be taken advantage of or avoided.

A swift current often occurs in a narrow passage connecting two large bodies of water, owing to their considerable difference of level at the same instant. The several passages between Vineyard Sound and Buzzards Bay are cases in point. In the Woods Hole passage the maximum strength of the tidal streams is at about high and low water.

Tide rips are made by a rapid current setting over an irregular bottom, as at the edges of banks where the change of depth is considerable.

Current arrows on charts show only the most usual or the mean direction of a tidal stream or current; it must not be assumed that the direction of a stream will not vary from that indicated by the arrow. The rate, also, of a stream constantly varies with circumstances, and the rate given on the chart is merely the mean of those found during the survey, possibly from very few observations.

FIXING POSITION.

Sextant method.—The most accurate method available to the navigator of fixing a position relative to the shore is by plotting with a protractor, sextant angles between three well-defined objects on shore which are shown on the chart; this method, based on the "three-point problem" of geometry, should be in general use.

For its successful employment it is necessary: First, that the objects be well chosen; and, second, that the observer be skillful and rapid in his use of the sextant. The latter is only a matter of practice. Two observers are better for this method.

Near objects should be used either for bearings or angles for position in preference to distant ones, although the latter may be more prominent, as a small error in the bearing or angle or in laying it on the chart has a greater effect in misplacing the position the longer the line to be drawn.

On the other hand distant objects should be used for direction, because less affected by a small error or change of position.

The three-arm protractor or station pointer consists of a graduated brass circle with one fixed and two movable radial arms, the three beveled edges of the arms, if produced, intersecting at the exact center of the instrument. The edge of the fixed arm marks the zero of the graduation which enables the movable arms to be set at any angles with the fixed arm.

To plot a position, the two angles observed between the three selected objects are set on the instrument, which is then moved over the chart until the three beveled edges pass respectively and simultaneously through the three objects. The center of the instrument will then mark the ship's position, which may be pricked on the chart or marked with a pencil point through the center hole.

The transparent xylonite protractor is an excellent substitute for the brass instrument and in some cases preferable to it, as when, for instance, the objects angled on are so near the observer that they are more or less hidden by the circle of the instrument. The xylonite protractor also permits the laying down for simultaneous trial of a number of angles in cases of fixing important positions. Plain tracing paper may also be used if there are any suitable means of laying off the angles.

The value of a determination depends greatly on the relative positions of the objects observed. If the position sought lies on the circle passing through three objects (in which case the sum of the observed angles equals the supplement of the angle at the middle object made by lines from the other two) it will be indeterminate, as it will plot all around the circle. Such an observation is called a "revolver." An approach to this condition must be avoided. Near objects are better than distant ones, and, in general, up to 90° the larger the angles the better, remembering always that large as well as small angles may plot on or near the circle and hence be worthless. If the objects are well situated, even very small angles will give for navigating purposes a fair position, when that obtained by bearings of the same objects would be of little value.

Accuracy requires that the two angles be simultaneous. If under way and there is but one observer the angle that changes less rapidly may be observed both before and after the other angle and the proper value obtained by interpolation.

A single angle and a range of two objects give in general an excellent fix, easily obtained and plotted.

Advantages of sextant method.—In many narrow waters where the objects may yet be at some distance, as in coral harbors or narrow passages among mud banks, navigation by sextant and protractor is invaluable, as a true position can in general be obtained only by its means. Positions by bearings are too rough to depend upon, and a small error in either taking or plotting a bearing might under such circumstances put the ship ashore.

In all cases where great accuracy of position is desired, such as the fixing of a rock or shoal, or of fresh soundings or new buildings as additions to the chart, the sextant should invariably be used. In all such cases angles should be taken to several objects, the more the better; but five objects is a good number, as the four angles thus obtained not only prevent any errors, but they at once furnish a means of checking the accuracy of the chart itself. If a round of angles can be taken the observer's accuracy is also checked. In the case of ordinary soundings a third angle need be taken only occasionally; first, to check the general accuracy of the chart, as above stated; second, to make certain that the more important soundings, as at the end of a line, are correctly placed.

If communication can be had with the shore, positions may be fixed with great accuracy by occupying with theodolite or sextant two known points of the chart. The third angle of the triangle, that between the two points at the position sought, should be measured as a check.

The compass.—It is not intended that the use of the compass to fix the ship should be given up; in ordinary piloting the compass, with its companion, the pelorus, may be usefully employed for this purpose, although less accurate than the sextant.

If the accuracy of the chart is doubtful, the compass should be used in preference to the sextant.

In fixing by the compass, it should always be remembered that a position by two bearings only, like that by two angles only, is liable to error. An error may be made in taking a bearing, or in applying to it the deviation, or in laying it on the chart. A third or check bearing should, therefore, be taken of some other object, especially when near the shore or dangers. A common intersection for the three lines assures accuracy.

When the three lines do not intersect in a point, the following rule holds: If the line drawn to the middle object falls to the right of the point of intersection of the lines to the two outside objects, the position of the observer was to the right of the line to the middle object; and if it falls to the left of the intersection his position was to the left of the line. Thus it will be seen that the assumption, that the position is at the center of the triangle formed by the intersecting lines, is incorrect.

Doubling the angle on the bow.—The method of fixing by doubling the angle on the bow is invaluable. The ordinary form of it, the so-called "bow and beam bearing," the distance from the object at the latter position being the distance run between the times of taking the two bearings, gives the maximum of accuracy, and is an excellent fix for a departure, but does not insure safety, as the object observed and any dangers off it are abeam before the position is obtained.

By taking the bearings at two points and four points on the bow, a fair position is obtained before the object is passed, the distance of the latter at the second position being, as before, equal to the distance run in the interval, allowing for current. Taking afterwards the beam bearing gives, with slight additional trouble, the distance of the object when abeam; such beam bearings and distances, with the times, should be continuously recorded as fresh departures, the importance of which will be appreciated in cases of being suddenly shut in by fog.

When the first bearing is 26½° from ahead, and the second 45°, the run between bearings will equal the distance at which the object will be passed abeam.

A table of multipliers of the distance run in the interval between any two bearings of an object, the product being its distance at the time of the second bearing, is given in the Light Lists and in Bowditch.

Danger angle.—The utility of the danger angle in passing outlying rocks or dangers should not be forgotten. In employing the horizontal danger angle, however, caution is necessary, as should the chart be inaccurate, i. e., should the objects selected be not quite correctly placed, the angle taken off from it may not serve the purpose. It should not, therefore, be employed when the survey is old or manifestly imperfect.

The vertical danger angle may be conveniently used when passing elevated points of known heights, such as lighthouses, cliffs, etc. The computation of the distance corresponding to the height of the object and its angular elevation requires for small distances merely the solution of a plain right triangle; the natural cotangent of the angle multiplied by the height in feet gives the distance in feet. The convenient use of this method, however, requires tables such as those published by Capt. Lecky in his little book entitled "The Danger Angle and Offshore Distance Tables." This book very usefully extends the vertical angle method to finding a ship's position at sea by observing the angular altitude of a peak of known height and its bearing. The tables give heights up to 18,000 feet and distances up to 110 miles.

When the angles are not too large they should be observed "on and off the limb" and the index error of the sextant thus eliminated, in preference to correcting for it the single altitude. It must be remembered that in high latitudes the bearing of a distant object needs correction for the convergence of the meridians before being laid down on a Mercator chart. The correction may be found by the following formula, using the approximate position: The sine of the correction equals the product of the sine of half the difference of longitude by the sine of the middle latitude. It is applied on the equatorial side of the observed bearing and its effect is always to increase the latitude of the observer.

Soundings taken at random are of little value in fixing or checking position and may at times be misleading. In thick weather, when near or closing the land, soundings should be taken continuously and at regular intervals, and, with the character of the bottom, systematically recorded. By laying the soundings on tracing paper, according to the scale of the chart, along a line representing the track of the ship, and then moving the paper over the chart, keeping the line representing the track parallel with the course until the observed soundings agree with those of the chart, the ship's position will in general be quite well determined. This plan was suggested by Lord Kelvin, whose admirable sounding machine renders the operation of sounding possible in quite deep water, without slowing down the ship and consequent loss of time.

Pelorus.—All ships should be supplied with the means of taking accurate bearings both by night and by day. The standard compass is not always conveniently placed for the purpose; in such case a pelorus will be very useful, but the results are not as accurate as those obtained direct from the compass. The utility of such an instrument in ascertaining the change of bearing of an approaching ship should not be overlooked.

Position lines.—Among the various methods of fixing position at sea, the one which should be best understood and put to the most constant use is that employing position or Sumner lines. These lines give the most comprehensive information to the navigator with the least expenditure of labor and time. The knowledge gained is that the vessel must be somewhere on the line, provided the data used is accurate and the chronometer correct. As the information given by one line of position is not sufficient to determine the definite location of the vessel, it is necessary to cross this line by another similarly obtained, and the vessel being somewhere on both must be at their intersection. However, a single line, at times, will furnish the mariner with invaluable information; for instance, if it is directed toward the coast, it marks the bearing of a definite point on the shore, or if parallel to the coast, it clearly indicates the distance off, and so will often be found useful as a course. A sounding taken at the same time with the observation will in certain conditions prove of great value in giving an approximate position on the line.

The easiest and quickest way to establish a line of position is by employing the method of Marcq St. Hilaire, as modified by the use of tables of altitude. The principle of this method is one of altitude differences, in which the observed altitude is compared with the computed altitude for a dead reckoning, or other selected position, and the difference in minutes of latitude measured toward the body along the line of its azimuth, if the observed altitude is greater than the computed altitude, and vice versa. A line drawn at right angles to the line of azimuth through the point thus determined is the position line, somewhere upon which will be found the position of the vessel. The tables of altitude obviate the computation of the altitude and thereby greatly facilitate the establishment of the line.

A position line may also be found by computing two positions for longitude with two assumed latitudes, and drawing the line between them; or by drawing to the position obtained with one latitude a line at right angles to the bearing of the body as taken from the azimuth tables.

A very accurate position can be obtained by observing two or more stars at morning or evening twilight, at which time the horizon is well defined. The position lines thus obtained will, if the bearings of the stars differ three points or more, give an excellent result. A star or planet at twilight and the sun afterwards or before may be combined; also two observations of the sun with sufficient interval to admit of a considerable change of bearing. In these cases one of the lines must be moved for the run of the ship. The moon is often visible during the day and in combination with the sun gives an excellent fix.

The morning and evening twilight observations, besides their great accuracy, possess the additional advantage of greatly extending the ship's reliable reckoning beyond the limits of the ordinary day navigation, and correspondingly restricting the dead reckoning uncertainties of the night. An early morning fix in particular is often of great value. Though the same degree of accuracy as at twilight can not be expected, night observations are very valuable and should be assiduously practiced.

Piloting.—The navigator, in making his plan for entering a strange port, should give very careful previous study to the chart and sailing directions, and should select what appear to be the most suitable marks for use, also providing himself with substitutes to use in case those selected as most suitable should prove unreliable in not being recognized with absolute certainty. Channel buoys seen from a distance are difficult to identify, because their color is sometimes not easily distinguished and they may appear equally distant from the observer even though they be at widely varying distances. Ranges should be noted, if possible, and the lines drawn, both for leading through the best water in channels, and also for guarding against particular dangers; for the latter purpose safety bearings should in all cases be laid down where no suitable ranges appear to offer. The courses to be steered in entering should also be laid down and distances marked thereon. If intending to use the sextant and danger angle in passing dangers, and especially in passing between dangers, the danger circles should be plotted and regular courses planned, rather than to run haphazard by the indications of the angle alone, with the possible trouble from bad steering at critical points.

The ship's position should not be allowed to be in doubt at any time, even in entering ports considered safe and easy of access, and should be constantly checked, continuing to use for this purpose those marks concerning which there can be no doubt until others are unmistakably identified.

The ship should ordinarily steer exact courses and follow an exact line, as planned from the chart, changing course at precise points, and, where the distances are considerable, her position on the line should be checked at frequent intervals. This is desirable even where it may seem unnecessary for safety, because if running by the eye alone and the ship's exact position be immediately required, as in a sudden fog or squall, fixing at that particular moment may be attended with difficulty.

The habit of running exact courses with precise changes of course will be found most useful when it is desired to enter port or pass through inclosed waters during fog by means of the buoys; here safety demands that the buoys be made successively, to do which requires, if the fog be dense, very accurate courses and careful attention to the times, the speed of the ship, and the set of the current; failure to make a buoy as expected leaves, as a rule, no safe alternative but to anchor at once, with perhaps a consequent serious loss of time.

In passing between dangers where there are no suitable leading marks, as, for instance, between two islands or an island and the main shore, with dangers extending from both, a mid-channel course may be steered by the eye alone with great accuracy, as the eye is able to estimate very closely the direction midway between visible objects.

In piloting among coral reefs or banks, a time should be chosen when the sun will be astern, conning the vessel from aloft or from an elevated position forward. The line of demarcation between the deep water and the edges of the shoals, which generally show as green patches, is indicated with surprising clearness. This method is of frequent application in the numerous passages of the Florida Keys.

Changes of course should in general be made by exact amounts, naming the new course or the amount of the change desired, rather than by ordering the helm to be put over and then steadying when on the desired heading, with the possibility of the attention being diverted and so of forgetting in the meantime, as may happen, that the ship is still swinging. The helmsman, knowing just what is desired and the amount of the change to be made, is thus enabled to act more intelligently and to avoid bad steering, which in narrow channels is a very positive source of danger.

Coast piloting involves the same principles and requires that the ship's position be continuously determined or checked as the landmarks are passed. On well surveyed coasts there is a great advantage in keeping near the land, thus holding on to the marks and the soundings, and thereby knowing at all times the position, rather than keeping offshore and losing the marks, with the necessity of again making the land from vague positions, and perhaps the added inconvenience of fog or bad weather, involving a serious loss of time and fuel.

The route should be planned for normal conditions of weather, with suitable variations where necessary in case of fog or bad weather or making points at night, the courses and distances, in case of regular runs over the same route, being entered in a notebook for ready reference, as well as laid down on the chart. The danger circles for either the horizontal or the vertical danger angles should be plotted, wherever the method can be usefully employed, and the angles marked thereon; many a mile may thus be saved in rounding dangerous points with no sacrifice in safety. Ranges should also be marked in, where useful for position or for safety, and also to use in checking the deviation of the compass by comparing, in crossing, the compass bearing of the range with its magnetic bearing, as given by the chart.

Changes of course will in general be made with mark or object abeam, the position (a new "departure") being then, as a rule, best and most easily obtained. The pelorus should be at all times in readiness for use, and the chart where it may be readily consulted by the officer of the watch. The sextant should also be kept conveniently at hand.

A continuous record of the progress of the ship should be kept by the officer of the watch, the time and patent-log reading of all changes of course and of all bearings, especially the two and four point bearings, with distance of object when abeam, being noted in a book kept in the pilot house for this especial purpose. The ship's reckoning is thus continuously cared for as a matter of routine and without the presence or particular order of the captain or navigating officer. The value of thus keeping the reckoning always fresh and exact will be especially appreciated in cases of sudden fog or when making points at night.

Where the coastwise trip must be made against a strong head wind, it is desirable, with trustworthy charts, to skirt the shore as closely as possible in order to avoid the heavier seas and adverse current that prevail farther out. In some cases, with small ships, a passage can be made only in this way. The important saving of coal and of time, which is even more precious, thus effected by skillful coast piloting makes this subject one of prime importance to the navigator.

Change in the variation of the compass.[1]—The gradual change in the variation must not be forgotten in laying down on the chart courses and bearings. The magnetic compasses placed on the charts for the purpose of facilitating the plotting become in time slightly in error, and in some cases, such as with small scales or when the lines are long, the displacement of position from neglect of this change may be of importance. The date of the variation and the annual change, as given on the compass rose, facilitate corrections when the change has been considerable. The compasses are reengraved once in ten years; more frequent alterations on one spot in a copperplate would not be practicable.

The change in the variation is in some parts of the world so rapid as to need careful consideration, requiring a frequent change of the course. For instance, in approaching Halifax from Newfoundland the variation changes 10° in less than 500 miles.

Local magnetic disturbance of the compass on board ship.—The term "local magnetic disturbance" has reference only to the effects on the compass of magnetic masses external to the ship. Observation shows that disturbance of the compass in a ship afloat is experienced in only a few places on the globe.

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[1] See H. O. Chart No. 2406, Variation of the compass

Magnetic laws do not permit of the supposition that the visible land causes such disturbance, because the effect of a magnetic force diminishes so rapidly with distance that it would require a local center of magnetic force of an amount absolutely unknown to affect a compass half a mile distant.

Such deflections of the compass are due to magnetic minerals in the bed of the sea under the ship, and when the water is shallow and the force strong, the compass may be temporarily deflected when passing over such a spot; but the area of disturbance will be small unless there are many centers near together.

Use of oil for modifying the effect of breaking waves.—Many experiences of late years have shown that the utility of oil for this purpose is undoubted, and the application simple.

The following may serve for the guidance of seamen, whose attention is called to the fact that a very small quantity of oil, skillfully applied, may prevent much damage both to ships, especially of the smaller classes, and to boats by modifying the action of breaking seas.

The principal facts as to the use of oil are as follows:

1. On free waves, i. e., waves in deep water, the effect is greatest.
2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain, as nothing can prevent the larger waves from breaking under such circumstances; but even here it is of some service.
3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use; crude petroleum is serviceable when no other oil is obtainable, or it may be mixed with other oils; all animal and vegetable oils, such as waste oil from the engines, have great effect.
4. In cold water, the oil, being thickened by the low temperature and not being able to spread freely, will have its effect much reduced, a rapid-spreading oil should be used.
5. A small quantity of oil suffices, if applied in such a manner as to spread to windward.
6. It is useful in a ship or boat either when running, or lying-to, or in wearing.
7. When lowering and hoisting boats in a heavy sea the use of oil has been found greatly to facilitate the operation.
8. For a ship at sea the best method of application appears to be to hang over the side, in such a manner as to be in the water, small canvas bags, capable of holding from 1 to 2 gallons of oil, the bags being pricked with a sail needle to permit leakage. The waste pipes forward are also very useful for this purpose.

9. Crossing a bar with a flood tide, to pour oil overboard and allow it to float in ahead of the boat, which would follow with a bag towing astern, would appear to be the best plan.

On a bar, with the ebb tide running, it would seem to be useless to try oil for the purpose of entering.

10. For boarding a wreck, it is recommended to pour oil overboard to windward of her before going alongside, bearing in mind that her natural tendency is always to forge ahead. If she is aground the effect of oil will depend upon attending circumstances.

11. For a boat riding in bad weather to a sea anchor, it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil can be diffused well ahead of the boat, and the bag readily hauled on board for refilling, if necessary.

CHAPTER I.

GENERAL DESCRIPTION AND NAVIGATION—WINDS AND WEATHER; STORM, TELEGRAPH, RESCUE, DISTRESS, AND ICE SIGNALS; CURRENT; TIDES AND TIDAL STREAMS; SUNKEN WRECKS; BUOYAGE; TIDAL, PILOT, AND TIME SIGNALS; TELEGRAPH STATIONS; ROUTES.

NOTE.—It must be remembered that at present (June, 1918) numerous changes in aids to navigation have been made, harbors obstructed, and new traffic regulations promulgated, and that data for such temporary changes are not available for a work of this nature.

The North Sea—General remarks.—The North Sea is bounded on the west by the British Isles, on the east by Norway and Denmark, on the south by Germany, Holland, Belgium, and France, while on the north it is open to the Northern or Arctic Ocean. Lying between the parallels of 51° and 61° N., and meridians of 2° 30′ W. and 8° 31′ E., its greatest length is about 600 miles, and its breadth (from St. Abbs Head to Hanstholm on the opposite shore of Denmark) 360 miles. The shores of the North Sea are indented by bays, fiords, inlets, and estuaries; and the Skagerrack, an arm of it dividing Denmark and Norway, communicates through the Kattegat with the Baltic.

If the North Sea be divided into two unequal portions by a line drawn from Flamborough Head to the Texel, the northern part will be found to possess a comparatively uniform depth; the southern section, on the contrary, while limited in area, is the receptacle of several considerable rivers, such as the Humber, Thames, Schelde, and Maas, and is encumbered with sand banks, rendering its navigation difficult and even impracticable for heavy draft ships without artificial marks.

The general depths in the North Sea are moderate, with the exception of a remarkable depression along the Scandinavian coast, where they vary from 130 to 270 fathoms. The soundings generally decrease from north to south, but the floor of this sea is very irregular.

Among the sand banks in the northern portion of the North Sea is one known to mariners as the Long Forties, which extends from the Firth of Forth northeasterly for about 110 miles, while the Jutland banks may be traced for upward of 100 miles in a westerly direction. Besides the great central mass, known as the Dogger Bank, there are a number of shoals and sand banks lying southward of the line joining Flamborough Head and Helgoland. Though too numerous to be particularized here, it may be mentioned that off the coasts of England, France, and Belgium they generally assume the form of ridges trending nearly parallel to the shore or the tidal currents, while the coast of North Holland is fronted by a broad flat.

General navigation.—The difficulty of the navigation in the southern portion of the North Sea arises not only from the shores there being so low as seldom to be visible to a greater distance than 10 or 12 miles, even in clear weather, but also to the existence of the numerous sand banks, the strong tidal currents, and to the prevalence of fogs and misty weather during certain portions of the year; so that the utmost caution and vigilance is necessary on the part of the mariner.

It is well to remember also that there is much traffic in the southern portion of the North Sea, and that, as a general rule, this traffic is becoming more and more restricted to steamers, which follow stated routes, and that the routes across the sea, from Great Britain and the Continent, cross the routes up and down either coast in certain localities. For instance, the ports in the Humber keep up a constant communication with Holland, Norway, and the Baltic. Harwich has lines running to Antwerp and the Hook of Holland; from the Tyne steamers run constantly to the Continent, Baltic, and Norway, while fishing craft congregate in great numbers on the Broad Fourteens, off the Texel and off the Horn Reefs, so that in these localities extra caution is necessary to avoid collision, especially in thick weather.

The navigator's chief reliance will be found to be in the lead, log, and lookout, and a knowledge of the set of the tidal currents, as regards their strength and moment of change of direction.

On the attention bestowed upon these points the safety of the vessel principally depends.

When navigating in the channels between the off-lying shoals it should be always borne in mind that the tidal current has a tendency to set obliquely across the shoals, and that it does not change at high and low water, so that frequently it is running at its greatest force at high water; also that in gales the sand banks are marked by breakers, and that if breakers are seen in thick weather and the position of the ship is uncertain, a fairly sheltered anchorage may be found under the lee of the breakers until the weather clears.

While closing the coasts, and at all uncertain as to position, it must be held as far safer to "heave to" than to run on, or in case of getting into shallow water, to anchor rather than to keep underway; the loss of a few hours in the passage, or the trouble of weighing an anchor, ought never, for a single moment, to be allowed to prevail against the risk of periling life and property.

Marking of salvage vessels and marine works.—For protection against disturbance and danger to the work carried out by salvage vessels and to inshore works in German waters, a red cylinder upon these vessels and works by day, and by night three lights, vertical, 5 feet apart, the center light being red, the other two white.

Notices to mariners.—Important notices to mariners relating to alterations in lights, fog signals, buoys, and beacons outside harbors, wrecks, and other obstructions off the German coasts, are under ordinary circumstances posted at the harbor master's office or other convenient place, for the benefit of mariners, at many of its ports.

Docks are available at the several ports included in this work for all vessels that can enter them. (See Appendix.)

Winds and weather.—The winds and weather may be considered from three points of view—(1) the general direction of the wind throughout the year, (2) the prevailing types in summer and winter, and (3) the disturbances occurring at all seasons of the year.

With regard to the general direction of the wind, as well as to the prevailing types, in summer and winter, it is now well established that the course of the wind and the pressure of the atmosphere are intimately connected, the wind having a tendency to circulate around areas of high and low pressure, but in different directions. The circulation around the low pressure areas (following invariably the law that holds good in revolving storms) is known as the "cyclonic" system, and that around high pressure areas (exactly contrary to the low pressure system) is termed "anticyclonic."

It follows, therefore, that if the distribution of pressure be known, the direction of the wind can be readily ascertained, and, vice versa, if the direction of the wind be known, the direction in which the high and low pressure areas are situated can be determined. A knowledge of this fact is of great importance to the seaman, as he is thus able to avoid standing toward a low barometer when in his opinion his so doing might lead his vessel into danger. This law, known as Buys Ballot's law, from the meteorologist who first promulgated it, is extremely simple. It is merely "if the face of an observer be directed to the wind, the low pressure area will be on his right and the high pressure area on his left in the Northern Hemisphere," while in the Southern Hemisphere the low pressure area will be on his left and the high pressure area on his right.

When considering the mean distribution of pressure and the mean annual direction of the wind, it is necessary to study the varying conditions of the wind and pressure over considerable tracts. Thus over the British Isles the direction of the wind approximates to the general circulation of the atmosphere on the adjoining continent; for, as the mean pressure in the neighborhood of Iceland is low, the wind circulates around this low pressure area; consequently the prevailing wind in Greenland is northerly and easterly, on the Danish and Norwegian coast south and southeasterly, and over the British Isles west and southwesterly. In accordance, therefore, with Buys Ballot's law, the mean atmospheric pressure should decrease from the south toward the north; and this observation proves to be the case, as the mean annual pressure at the Shetland Isles is 29.78 inches, increasing steadily to 29.96 at Dungeness, the Isle of Wight, Portland, and the Start.

Although the mean annual direction of the wind is from the west, easterly winds are by no means uncommon. In point of fact the wind and weather may be divided into two types—the westerly and easterly—one of which is generally prevailing over the North Sea. With the westerly type of wind the atmospheric pressure is lowest over Iceland and highest to the southward of the British Isles, while with the easterly type the pressure is highest in the north and lowest in the south. The westerly type is most common during the months of December, January, February, July, August, and September, while the easterly type is most common in March, April, May, and November; June and October may be regarded as intermediate months.

The characteristic of the westerly type is that the wind, commencing southerly with a comparatively high temperature, a dull sky, and rain, veers to the westward, with a cooler air and brighter sky, and after a day or so of fine weather backs again to the south, with bad weather, sometimes rising to the force of a gale, and so on for weeks together.

The characteristic of the easterly type is that the wind fluctuates between southeast by east and northeast by north, the southeast by east winds bringing foul weather and the northeast by north finer weather, veering and backing with many variations for a considerable period. The change from the easterly to the westerly type is often preceded by a movement in the upper clouds. If, with the easterly type prevailing, cirrus and stratus clouds be seen moving from west to east a change is nearly certain to follow.

Land and sea breezes are not phenomena of regular occurrence on the shores of the North Sea, but are occasionally observed in fine settled weather during the summer.

Although the westerly type of wind is most common in certain months and the easterly in others, the variable nature of the climate in the North Sea does not permit predicting that such a type will be certain to prevail during the period in which it is most common. A general outline of observed facts is all that meteorology can at present give with a certainty, as forecasts for even 24 hours can not be implicitly relied on.

Gales or strong winds are by no means infrequent. They are usually produced by the depressions visiting the British Isles, the greatest number of which skirt Ireland and the northwest coast of Scotland, causing gales from southeast by east, shifting to southwest by south; but it is by no means uncommon for these depressions to pass across Great Britain and the North Sea. To the southward of their track the wind will veer to the southward and westward, while to the northward of their track it will back to east by north, northeast by north, and northwest by west. Seamen must be guided in their judgment as to the track of the depression by frequent observations of the barometer and the force and direction of the wind, constantly bearing in mind Buys Ballot's law, and remembering that the harder it blows the greater is the barometric gradient. The usual track of depressions in the vicinity of Great Britain is from some westerly point to some easterly point, but the reverse takes place occasionally, and they have been known to cross Great Britain on the north, travel to the southward in the North Sea, and pass down the English Channel to the westward. The barometer is the best guide in foretelling gales. An unsteady barometer nearly always means unsettled weather, while a steady barometer generally means settled weather. Swell in the offing or a surf on the coast often precede gales and point to the direction from which they will come.

Calms are of rare occurrence, even in summer, and do not last long. In winter they often occur when anticyclonic conditions prevail, at which time the barometer is high and fog nearly always prevalent.

Snow.—In some winters snow is abundant. The wind is often fresh and baffling in snow squalls, and the falling snow effectually obscures all objects from view. After a snowfall there is often great difficulty in recognizing the land which may be in sight, the snow completely altering its aspect.

A change from rain to hail often accompanies or precedes sudden changes in the wind from a southerly to a more northerly direction.

Fogs may occur at all seasons of the year, but are most common when anticyclonic conditions prevail, especially in the winter. In summer they generally hide the land in the morning only and disperse as the sun acquires strength. The moist haze accompanying westerly winds is more tenacious and only yields to a freshening breeze; it then frequently turns to rain and marks the commencement of bad weather.

Thick weather, approaching to a fog, is very common. The northeast by north winds of spring bring, as a rule, the clearest weather.

From observations extending over a period of about 30 years the most foggy season in the North Sea appears to extend from April to July, the latter month being on an average the most foggy of the year; the clearest period extends from October to December.

The most foggy part of the North Sea is usually within 100 miles of the coast on either side, extending to a distance of 150 miles in July, the southern portion, and the English coast in particular, experiencing the thickest weather.

In the southern part foggy weather occurs almost exclusively with winds from the southwestward, but in summer is often associated with calms.

In the vicinity of Dover Strait during October and November fogs occur with equal frequency during winds from almost any direction.

On the western side northeasterly winds bring as a rule the clearest weather.

In January, southward of a line joining the Tees River and Blaavand Point in Denmark, fog occurs on about six days; northward of this line usually about the same number of misty days occur.

In February and March, southwestward of a line joining Spurn Point and the mouth of Schelde River, fog occurs on about six days each month, but over the rest of the sea only about three foggy or misty days are experienced. Fog is very prevalent in March at the entrance to the Skagerrack.

In Dover Strait and the Thames estuary fog occurs on about nine days in each month.

During April and May fog occurs on the western side on from six to ten days each month, but is less developed on the eastern side and in the central area.

In June fog usually occurs for more than ten days in Dover Strait and the Thames estuary, and for from three to six days over the other parts of the sea, being most prevalent on the English coast and over the central portion of the sea.

During July fog is experienced on more than six days in all parts, and on more than ten days in Dover Strait, the Thames estuary, and over two large areas, one extending from Buchan to near the Humber River, and the other situated northwestward of the Elbe River estuary.

In August about three or four days of fog or mist occur over the whole sea, increasing to about ten days between the Orkneys and the coast of Norway.

In September fog is experienced for about four days on each side and for about seven days in the central portion.

During October in Dover Strait, the Thames estuary, and on the eastern side fog occurs on about five days; over the Orkney and Shetland Islands on from four to seven days, and over the rest of the sea from five to seven misty days occur.

In November fog is experienced for about five days in Dover Strait, the Thames estuary, and on the eastern side of the sea; over other parts of the English coast on from seven to ten days, and elsewhere from three to ten misty days occur.

During December on the English coast fog occurs on about ten days, and on the eastern side of the sea on about four days. The northern portion appears to be the most clear.

Caution respecting fog signals from light vessels or lighthouses.—It has been clearly shown—

1. That fog signals are heard at greatly varying distances.

2. That under certain conditions of atmosphere, when a fog signal is a combination of high and low tones, one of the notes may be inaudible.

3. That there are occasionally areas around a fog signal in which it is wholly inaudible.

4. That a fog may exist a short distance from a station and not be observable from it, so that the signal may not be sounded.

5. That some fog signals can not be started at a moment's notice, though every endeavor will be made to sound them as quickly as possible, after signs of fog have been observed.

Mariners are therefore warned that fog signals can not be implicitly relied upon, and that the lead should never be neglected. Particular attention should also be given to placing "lookout men" in positions in which the noises in the ship are least likely to interfere with the hearing of the sound of a fog signal, as experience shows that though such a signal may not be heard from the deck or bridge when the engines are moving, it may be heard when the ship is stopped or from a quiet position. It may also be heard from aloft though not on deck.

Submarine fog bells have been fitted to several light vessels mentioned in this work.

The Netherlands Government has given notice that the flags Z N Q, International Code, will be hoisted on board the Netherlands light vessels when submarine bells are being sounded experimentally, to enable mariners to acquire proficiency in the method of receiving these signals.

Mirage is frequent in certain parts, and is considered an indication of fine weather if it tends only to enlarge the apparent size of objects; but when it distorts and renders them difficult of recognition it is usually followed by rain or by strong easterly winds. When mirage is prevalent about sunset it may be expected that as night draws on the lights will become visible at much greater distances than under ordinary circumstances.

Barometer.—The average range of the barometer in the higher latitudes (i e., 50° to 60°) is about 1.5 inches, but on extraordinary occasions, ranges of 2.75 and 3 inches have been recorded.

In the Northern Hemisphere the effects of the veering of the wind on the barometer is according to the following law: With east, southeast, and south winds the barometer falls; with southwest winds the barometer ceases to fall and begins to rise; with west, northwest, and north winds the baromter rises; with northeast winds the barometer ceases to rise and begins to fall.

Thermometer.—The thermometer in the Northern Hemisphere rises with east, southeast, and south winds. With a southwest wind it ceases to rise and begins to fall. It falls with west, northwest, and north winds; with northeast winds it ceases to fall and begins to rise.

Storm signals—General remarks.—Storm signals are shown from signal masts and from certain of the lighthouses at a number of places on the shores of the North Sea for the convenience of the seamen.

Netherlands storm signals are as follows:

A black ball indicates that a storm is probably approaching from an unknown direction and vessels should be prepared.

A cone, point downward, indicates a storm from southwestward.

A cone, point upward, indicates a storm from northwestward.

Two cones, points downward, indicate a storm from southeastward.

Two cones, points upward, indicate a storm from northeastward.

A black flag indicates that the wind will be strong and shifting to the right.

Two black flags indicate that the wind will be moderate and shifting to the left.

A red light, shown at night (only shown at some of the principal stations), will indicate the same as signal 1 (a black ball) by day.

The Netherlands Government fishery service vessel will display the above storm signals when to the southward of the parallel of 55° N. latitude; but instead of the red light at night three lights, white, red, white, will be shown vertically, visible all around from a distance of 2 miles.

Night signals.—The undermentioned system of night storm signals has been established at the following places on the coasts of the Netherlands:

Bruinisse; Willemsdorp; Maassluis; Ter Heyde (Terheiden); Scheveningen; Katwijk aan Zee; Zandvoort; Ymuiden; Egmond aan

Zee; De Helder; Nieuwe Diep (Willemsoord); and at Ven Hoek, De Lemmer, Stavoren, and Harlingen, in the Zuider Zee; and at Delfzjl.

Signal.	Signification.
Two white lights, vertical	Gale probable from southwestward.
Two red lights, vertical	Gale probable from northwestward.
A white light over a red light	Gale probable from southeastward.
A red light over a white light	Gale probable from northeastward.
One red light	Caution: gale probable.

Weather signals.—At the principal ports a pillar with movable arms denotes the direction of both high and low barometric pressure and angle of the gradient.

In a frame near the pillar is a record of the two previous days' observations to enable the seaman to judge of the probable weather for himself.

German storm signal stations are divided into two classes, those of the first class having a signal staff, with a yard to which the signals are hoisted, and those of the second class, a post, to which a ball is hoisted, as a signal that a storm is approaching, of which information may be obtained at the signal station.

A signal signifies that in the neighborhood of the locality where it is shown, within a circuit of about 100 miles radius, a storm from the direction indicated is probable.

Southerly gales are indicated by cones, apex downward; one cone so displayed indicates a gale expected from southwestward.

Two cones vertically, with apex downward, indicate a gale expected from southeastward.

Northerly gales are indicated by cones, apex upward; one cone so displayed indicates a gale expected from northwestward.

Two cones vertically, with apex upward, indicate a gale expected from northeastward.

Denmark—Storm signals.—A uniform system of storm signals has been established on the coasts of Denmark.

These signals, which are made by means of cones and balls displayed at one end of a yard and flags or lights on the other end, are as follows:

One black ball: An atmospheric disturbance in the nighborhood; gale expected.

One black cone, point upward: Gale expected from between north and west.

One black cone, point downward: Gale expected from between south and west.

Two black cones, shown vertically, points upward: Gale expected from between north and east.

Two black cones, shown vertically, points downward: Gale expected from between south and east.

One red flag by day or a fixed red lantern light by night, displayed with any of the above signals, indicates that the wind is veering or shifting to the right.

Two reg flags by day or two fixed red lantern lights displayed by night indicate that the wind is backing or shifting to the left. The above lights will be screened in such a way as to prevent their being mistaken for lights exhibited for the purpose of navigation.

For fishing vessels.—The following signals have been established on the west coast of Jutland for the purpose of warning those in fishing vessels of approaching storms. The station indicates also the spots where landing is practicable. The signals are shown from a mast with yards, and consist of one, two, or three balls by day, and one, two, or three white lights by night. In thick weather a horn is sounded and a gun fired by day and rockets by night.

A ball at the masthead indicates the sea is rising, but landing here is still possible.

A ball at the masthead and one at either yardarm indicates there is danger; seek landing along the coast in direction of the ball or light at the yardarm.

A ball at the masthead and one at each yardarm indicates expect the lifeboat.

Sound signals from a horn in thick weather:

No. 1. By three long notes.

No. 2. By one short and one long note.

No. 3. By one long and one short note.

No. 4. By one long, two short, and one long note.

The landing places are marked by day by two red and white flags in line, and by night by two red lights in line. In thick weather three long notes of the horn, as in signal No. 1.

Signal stations.—A number of signal stations connected with the telegraph systems of the several countries are established on the shores of the North Sea. Vessels can communicate by the International Code. Stations not connected will repeat the signal.

Danish harbors—Searchlights.—Any vessel approaching a defended port in Denmark when searchlights are being worked, and finding that they interfere with her safe navigation, may make use of the following signals, either singly or combined:

(*a*) By flashing lamp, four short flashes followed by one long flash.

(*b*) By whistle, siren, or foghorn, four short blasts followed by one long blast.

Whenever possible both flashing lamp signals and sound signals should be used. On these signals being made the searchlight will be worked so as to cause the least inconvenience, being either obscured, raised, or its direction altered. The signals, which are designed to assist mariners and do not render the Government liable in any way, should not be used without real necessity. When vessels are not in the rays of the searchlight it is impossible to know which searchlight is causing inconvenience.

Rescue stations.—Lifeboat and rocket stations are established at a number of places, chiefly at the coast guard stations and lighthouses, on the shores of the North Sea. These stations are so numerous that it is scarcely possible anything of importance can escape notice. They are marked on the charts, lifeboat or lifeboat station, rocket apparatus or rocket station, or, where there are both, both are mentioned, and a list will be found in the index under the heading of life-saving stations.

Most of the stations are connected with the nearest telegraph station either by telegraph or telephone, and some are telegraph stations with which vessels can communicate as above mentioned.

Distress signals.—The International Code signals may be used by vessels in distress on the coasts covered by this work.

The under-mentioned rocket signals are established at the lighthouses for vessels seen in distress during the night:

1. Firing one rocket will signify that the signal of distress from the vessel has been seen, or that the vessel in distress has been seen from the lighthouse.

2. Firing two rockets within one minute of each other will signify that, wind and weather permitting, assistance will be rendered the vessel.

Ice.—Navigation on the continental rivers treated of in this volume may be interrupted by ice at any time from the middle of November to the middle of March. Some winters are severe and the navigation is very difficult if not impracticable, while some winters are so mild that the ice hardly forms at all.

Observations of ice conditions on the North Sea coasts were made for a period of eight years by the German Seewarte for the Imperial Government. These observations show that navigation by steamers is very rarely hindered, but the mouth of the Eider is closed to sailing vessels on an average for 10 days during the winter months.

Ice breakers are employed on the Schelde, Elbe, Weser, etc., when necessary.

The current in the North Sea in general is sensibly affected by the winds—a circumstance particularly necessary to be attended to by those bound from the British shores toward the opposite coast. With winds from the southwest quarter the current sets northeastward generally across Jutland Bank and the south side of the Skagerrak toward the Skaw, or varying its direction with the wind trends toward the coast of Norway. It is therefore necessary to be careful to ascertain that the vessel is not set ahead of the reckoning and every attention should be paid to the lead.

That prevailing westerly winds have the effect of producing a surface or drift current (apart from tidal phenomena) has also been observed on the coast between Horn Reefs and the Texel; and it seems to be further considered that this drift current flows out again to the northward, along the coast of Schleswig-Holstein, but that it is not of a permanent character.

The current along the coast of Jutland northward of Bovbierg (Lat. 56° 31′ N.) sets with westerly winds about 2 miles an hour, and with strong southerly gales more than 3 miles. Between Jutland Bank and the coast of Norway it generally sets to the westward even during westerly winds, and at the same time the current on the Jutland coast sets eastward.

With northerly and northwesterly winds it sets southward along the coast of Norway over the Jutland Bank, and along the coast of Jutland toward Helgoland. In strong winds or gales this current runs with a velocity of 1½ or 2 miles an hour and requires particular caution.

Tides.—At Ostende, with a rise of 16 feet at springs, the undulation is normal. As the wave advances eastward the low-water stand gradually increases in length until at the Hook of Holland, where the range at springs is but 6 feet, the tide stands near low water for a space of about 2½ hours. From the Hook of Holland eastward this peculiarity becomes gradually reversed, the low-water stand occupying less and less time and the high-water stand more and more until at the entrance to the Texel, where the range at springs is 5 feet, the tide stands at near high water for about 3½ hours. Eastward of the Texel, again, the time occupied by the high-water stand gradually decreases until at Rottum, where the spring range is 7½ feet, the wave again becomes normal until it finally disappears at the Skaw.

These peculiarities are probably due to the reflection of the North Sea undulation from the coasts of England and Belgium, together with the undulation which advances up the English Channel and passes through Dover Strait, meeting the undulation which travels southward along the east coast of Great Britain. The waves thus become superimposed at certain times and places, while at others they are widely separated.

It has not yet been ascertained by any decisive experiments whether the range of the tides between the northern coast of France and the estuary of the Thames is equal to that observed on the surrounding shores. All that is positively known on the subject is that as far as 15 or 16 miles from the French coast the vertical motion of the tides seems to follow very nearly the same law as on the shore;

they take place at the same times and appear to rise in an equal degree; but if the rise of water at springs on this coast, at Calais, for example, is compared with that observed at the same tides on the coasts of Belgium and Holland, as well as at several positions in the estuary of the Thames, and especially at Orfordness, it would appear that beyond the distance of 15 or 16 miles from the French coast, in a north by east and northeast by east direction, the range of tide decreases in the same manner as on the shores.

It is even probable that this decrease is very rapid, for in the middle of the North Sea, in latitude 52° 57′ N., longitude 3° 14′ E., it has been found that the rise and fall does not exceed 3 feet.

Further observations as to the rise and fall in the open parts of the North Sea are required before a definite rule can be laid down, but it is very improbable that the tidal range offshore is the same as on the coast, and caution is therefore requisite in diminishing the depths obtained at high water in order to compare them with the depths on the chart.

Tidal currents.—In the North Sea the general features of the current correspond exactly with those of the English Channel, but the direction of the current is reversed. As soon as the intermediate tide is passed, on coming from the westward, a ship enters the true current, which extends from the North Foreland to a line joining Leman and Ower Light Vessel and the Texel. To the northward of a line joining the Ower and Texel a mixed tide occurs, similar to that which is experienced off the Start, occasioned by the channel current encountering that of the offing current; and beyond these limits the time of slack water varies with the advance of the tidal hour, as at the entrance of the English Channel, and with this peculiarity also, that in a very short distance there occurs a difference of three hours in the time of slack water.

On the continental coast of the North Sea from Dunkerque to Helgoland the tidal currents bear a close resemblance to the currents in the channel and southern part of North Sea, as they consist of a pair of opposing or separating currents, the points of junction or separation being movable between the Hook of Holland and Ameland Island. From the Hook of Holland to Ameland the currents may therefore properly be designated as intermediate.

Between Dunkerque and the Hook of Holland the current will be found runing toward Dover when the tide is rising at that place and away from it when falling there. Between Ameland and Helgoland the current will be found running to the eastward with the rising tide at Dover and to the westward with a falling tide there.

At one hour after high or low water at Dover these currents meet or separate at the Hook of Holland; at two hours after, off Ymuiden; at three hours after, off the Texel; at four hours after, off Vlieland;

at five hours after, off Terschelling; and at high water at Dover this intermediate current is running from Ameland to Hook of Holland and at low water at Dover from Hook of Holland to Ameland.

On the coast north of Helgoland the current runs toward Helgoland with the water rising there and away from it with the water falling there.

It is proper here to draw attention to the fact that the high water interval at Helgoland is 11 h. 24 m., mean time of place. So that not only is it high water at Liverpool, Dover, and Helgoland almost at the same moment, but at these three places the currents on each side are setting toward them with a rising tide and away from them with a falling tide.

The true current in the southern part of the North Sea will always carry a vessel toward the North Foreland while the water is rising at Dover and from it while it is falling at that place. This current sets nearly northeast by north and southwest by south, except inshore, where it sets in the direction of the coast, and at the entrance of the Thames, where it is diverted from its course by the river. Near Dover Strait the current runs with a velocity of 2½ to 3 knots an hour, lessening to 1½ or 1¾ knots farther north.

On the banks near the Netherlands coast, between the Texel and Schelde, where there is scarcely any rise of tide, the current continues to run nearly 40 minutes longer than in other parts of the channel.

Caution.—Mariners should bear in mind that the direction of the tidal current in the offing in the North Sea is not to be taken as a sign of the rise of fall of the tide; for the vessel would be exposed to the greatest danger by running with what might be considered to be the flood current toward a shoal lying far from the land, under the idea that in consequence of the direction of the current the water was rising on that shoal and that it might be crossed. This current only ceases to be felt in the vicinity of some of those banks which are farthest out from the coasts of France and Belgium when it is nearly low water on the shore.

When desirous of crossing a bank lying within 15 or 16 miles of the French or Belgian coast, an approximate calculation should always be made of the number of feet the tide has risen above the soundings shown on the chart. A useful table for readily computing this will be found in the United States Coast and Geodetic Survey Tide Tables, Table 3. This does not apply to banks farther offshore, where, as observed in the remarks on tides, the rise is apparently small.

Many wrecks, some with masts visible above the water, are reported to lie between latitudes 50° 59′ 00″ N. and 55° 05′ 30″ N., and longitudes 1° 18′ 00″ E. and 7° 38′ 00″ E..

In the Schelde will be found numerous wrecks also.

Caution should be used and a sharp lookout kept, as the wrecks are very numerous and the majority submerged and not marked.

SYSTEMS OF BUOYAGE.

General remarks—Caution.—Owing to the constant alteration of the banks and channels of the rivers, such as the Schelde, Jade, Weser, etc., the positions of the buoys, other than those marking the entrances to the channels, such as outer fairway buoys, must not be relied on; even these at times are washed away. Vessels should take a pilot for the rivers. This caution includes gas buoys, the lights of which may at times go out.

Certain light vessels are removed at times for short intervals, without much notice, when repairs are required to the ship or moorings.

Riding lights are shown forward from the light vessels (except the Ruytingen) mentioned in this work, at a height of about 6 feet above the rail.

French light vessels will, if out of position, discontinue their characteristic lights and exhibit in place of them the signal "Not under control," according to the International Code, both day and night.

All light vessels can use the International Code if required.

Belgian uniform system of buoyage.—A portion of the western Schelde is buoyed by the Belgian Government. The Belgian system is an agreement with the Netherlands system of buoyage, described below.

When a wreck is marked by a buoy, such buoy will be a bell and gas buoy showing a green light.

Vessels marking wrecks carry by day two black balls and by night two bright lights horizontally and visible 1 mile. Steamers are to slacken speed when approaching any of these vessels.

Netherlands uniform system of buoyage.—The term "starboard hand" means that side which would be on the right hand going with the main stream of flood or in entering a harbor, river, or estuary from seaward. The term "port hand" means the left-hand side under the same circumstances.

Conical buoys are starboard-hand buoys as thus defined and are painted red.

Can or truncated buoys are port-hand buoys as thus defined and are painted black.

Spherical buoys mark the ends of middle grounds and are painted black and red in horizontal stripes. These buoys are always surmounted by topmarks, other buoys only in special cases. When they lie between buoys of the same shape and color they are painted in conformity with them.

Buoys lying outside and marking the approach to seaward channels are called distinguishing buoys and have no special color assigned to them. In the inner channels where necessary spar buoys are used.

The topmarks of buoys are as follows:

A diamond marks the outer or seaward side of a bank.

A cone marks the inner side of a bank.

A ball marks the starboard side of the fairway.

A truncated cone marks the port side of the fairway.

An upright and a diagonal cross are special topmarks and as regards the spherical buoys serve to indicate that the buoy may be passed on either side.

Beacons are also provided with topmarks.

The topmarks are of the same color as the buoys or beacons on which they are placed.

The buoys of sea channels are numbered consecutively (beginning from seaward) and marked by the first letter of the name of the channel. The numbers and letters are white.

Wrecks are marked by conical or truncated buoys, painted green, according as the wreck lies on the starboard or port side of the fairway. Should the wreck be in mid-channel, it will be marked by a truncated buoy on the one side and a conical buoy on the other side, which buoys are to be treated as port or starboard hand buoys, according to shape.

Vessels placed to mark the position of wrecks are distinguished as follows:

At night: By three fixed lights shown from a yard about 19 feet above the sea—a red light above a white light (about 2½ feet apart) on the side that shipping may safely pass and a red light on the other side. These lights should be visible 1 mile.

When the lights are hoisted on the wreck itself or the vessel placed to mark it is exactly over the wreck the red light above the white light will alone be shown.

By day: Black balls, similarly arranged.

The buoyage of the River Ems, which is maintained partly by Germany and partly by the Netherlands, has been altered to agree with the German uniform system of buoyage as described below.

German uniform system of buoyage.—The following uniform system of buoyage has been established in Germany:

The seaward entrances of channels not marked by light vessels, beacons, or moles have beacon buoys of the same color as the channel buoys, moored in such a position that the nearest channel buoys may be plainly seen from them.

The term "starboard hand" denotes that side of a channel which lies on the right hand of the mariner when entering from seaward, and the term "port hand" the left hand under the same circumstances.

Where a channel connects two parts of the sea, or two sheets of water separated by banks, the starboard hand is that side which lies on the right hand when entering from the westward and the port hand that on the left. The term "from the westward" is taken to include the whole of the western semicircle from north (true), inclusive, to south (true).

Buoys surmounted by a beaconlike structure, including whistle, light, and bell buoys, are called "beacon" buoys.

Should the entrance to a fairway from seaward not be distinguished by a light vessel or beacon, a beacon buoy is established as an approach buoy and is always situated so that the nearest fairway buoy can be seen from it.

Buoys, which can be passed on either side, established in fairways for purposes of giving special warnings, are painted black and white checkered.

Buoys showing a portion of a cylinder, with the arched side uppermost above water, are called "barrel."

Beacons consisting of a group of piles are called "d'Alben."

Beacons consisting of single stakes or perches and driven into the ground are called "perches"; these may be surmounted by branches or brooms.

Beacons consisting of young trees, with branches or branches only, are called "pricken."

Letters or numbers on channel buoys or beacons are painted white and begin with the buoy or beacon farthest seaward, but channels of considerable length may be divided into sections, each with a separate series of letters or numbers.

Starboard hand buoys are spar buoys, painted red; or where several channels are near each other or the water is not deep enough for spar buoys, can buoys painted red may be used.

Port hand buoys are conical buoys painted black.

Starboard hand beacons are beacons with spars painted red or perches. Port hand beacons are beacons without spars, painted black, or "pricken."

Mid-channel buoys, which may be passed on either side, are spherical buoys painted red and black, in stripes.

The extremes of middle grounds are marked by beacons or beacon buoys, painted red and black in stripes and are surmounted by a cross.

Shoals lying seaward of channels are marked by spar buoys, beacon buoys, or beacons. Should a shoal be so small that it can be marked by a single buoy or beacon and passed on any side, such buoy or beacon is painted black and white in stripes and surmounted by a drum.

Buoys and beacons marking the edges of shoals seaward of channels are painted white and surmounted by two vertical equilateral triangles, arranged as follows: When on the northern edge of the shoal, the points of both triangles upward; on the southern edge, points downward; eastern edge, point of upper triangle upward, point of lower triangle downward; western edge, points toward each other.

The name of the shoal, either in full or abbreviated, is painted on the buoys and beacons marking it, in black letters; and buoys and beacons on the edges of shoals have the letters N, S, O, or W painted on them in black letters to correspond with the side of the shoal on which they are situated.

Wreck buoys are either can, conical, or barrel buoys, painted green, with the word "Wrack" (wreck) painted on them in white letters. The distinguishing marks on wreck buoys are similar to those used for marking shoals seaward of channels.

Wreck buoys, when light buoys, show a green occulting or green flashing light.

Buoys marking the position of telegraph cables are spherical buoys painted green, with the word "Telegraf" or "T" painted on them in white letters. When shore beacons are used the outer beacon is a triangle and inner beacon a rectangle.

Buoys marking the boundaries of quarantine stations are either can, conical, or barrel buoys painted yellow.

Buoys marking target, mine, or torpedo grounds are barrel buoys painted yellow and surmounted by a small red flag.

Buoys and beacons for mooring purposes or to define the boundaries of a roadstead or used for surveying purposes are so constructed in shape, color, and topmarks as to prevent their being mistaken for any other buoys or beacons in the vicinity.

Buoys for marking fishing reserves are painted a light blue color, and when they have topmarks a bronze-colored fish is the symbol.

In winter special buoys are substituted where endangered by ice.

Light vessels.—When a light vessel is out of position, a large black or dark-colored flag will be displayed and in some vessels the daymarks will be lowered. By night the anchor light only will be shown.

Wreck-marking vessels.—The German Government adopted the English system of marking and passing wreck-marking vessels.

When a wreck-marking vessel is used, it shall, if possible, have its top sides colored green, with the word "Wreck" in white letters thereon and shall exhibit—

By day: Three balls on a yard 20 feet above the sea, two placed vertically at one end and one at the other, the single ball being on the side nearest to the wreck.

By night: Three fixed white lights similarly arranged, but not the ordinary riding light.

In narrow waters, or in rivers or harbors when a wreck-marking vessel is used, she shall carry a cross yard on a mast, with two balls by day placed horizontally not less than 6 nor more than 12 feet apart, and two lights by night, similarly placed. When a barge or open boat only is used, a flag or ball may be shown in the daytime.

Wreck marking.—When lights are shown from a wreck itself they will be a green light over a white light, placed vertically.

German dredger signals.—The following signals are shown by the steam dredgers employed in German coastal waters (with the exception of those moored in the lower Weser) to indicate the side on which vessels may pass: By day, a red ball; by night, two lights placed vertically, upper light red, lower white.

The signals to indicate the side of the dredger on which vessels may not pass, or the special signals to be shown should a channel be completely closed by a dredger, are in every case decided by the local authorities.

Danish uniform system of buoyage is as follows:

1. (*a*) Main channels.—In the main channels the shapes and colors of the buoys, as well as their topmarks, indicate the side of the fairway on which they are placed.

(*b*) The starboard side of the channel is marked by conical buoys painted red. When topmarks are used, they are either one, two, or three upturned brooms upon a red staff.

(*c*) The port side of the channel is marked by can buoys, painted white. When topmarks are used they are either one, two, or three down-turned brooms upon a white staff.

(*d*) Middle grounds, or dangers that may be passed on either side, are marked by conical buoys, painted red and white in stripes. When a topmark is used it is a ball, striped red and white, on a staff, also striped red and white.

Similar buoys may be used as mid-fairway guides to the entrance of a channel from sea.

(*e*) Light buoys and whistle buoys, as regards color and topmark (if they have any), and bell buoys, with regard to shape, are in accordance with the system given above.

2. (*a*) Small channels.—In the smaller channels the color and topmark (if they carry one) of perches indicate the side of the channel on which they are placed, thus:

(*b*) The starboard side of the channel is marked by perches painted red and surmounted by one or two brooms.

(*c*) The port side of the channel is marked by perches, painted white, and surmounted by one or two straw wisps.

(*d*) Middle grounds and dangers that may be passed on either side are marked by perches, painted red and white in stripes, and surmounted by a broom over a straw wisp.

(*e*) Mid-fairway marks are painted red and white in stripes and surmounted by a red and white striped ball.

3. (*a*) Application of system.—The starboard side of a fairway is that which is on the starboard side of a vessel when entering, and the port side that which is on the port side.

(*b*) In landlocked fiords and inlets to a port or roadstead, a vessel is said to be entering when coming from seaward.

(*c*) Lim Fiord is considered a landlocked fiord; the meeting point being Logstor.

Mooring buoys are painted black.

Wreck buoys are painted green and carry as topmark (if used) a green flag on a green staff.

Danish light vessels.—When a light vessel is driven from her proper station and is anchored elsewhere the flags Z K C of the International Code, "Incorrect," will be hoisted and the daymarks will, if possible, be struck; an anchor light only will be shown.

Danish wreck-marking vessels.—The Danish Government adopted the English system for marking and passing wreck-marking vessels.

Cable beacons.—Submarine telegraph and telephone cables in Danish waters will be marked uniformly by pole beacons painted in red and white horizontal bands. The rear beacon will be surmounted by a red disk with a narrow white border over a white diamond shape with a narrow red border; if lighted, a fixed red light over a fixed white light will be established on such beacons.

The front beacon will be surmounted by a red disk with a narrow white border; if lighted, a fixed red light will be established on such beacons.

The existing beacons will be gradually altered to conform to this system.

Winter buoyage.—Over all the continental coast of the North Sea, when ice prevails, the light vessels in the rivers and occasionally in the entrances have sometimes to be removed, but are replaced as soon as practicable. In important places in the rivers, specially constructed spar buoys are substituted for light and whistle buoys and other large buoys. A large number of buoys in the rivers are removed annually for the winter. In severe winters the exposed buoys and beacons can not be implicitly relied on, and navigation consequently requires extra precaution.

The dates of adoption of the winter system of buoyage, and also that of the resumption of the summer system, on the coasts of Germany are published by the German Government.

Steering commands.—Austria, Germany, Greece, Italy, Japan, the Netherlands, Norway, Portugal, Russia, Spain, and Sweden have adopted the French system of steering comands, viz: "Starboard" means that the ship's head is to go to starboard and "port" means that the ship's head is to go to port.

Pilot vessels—Lights.—The various Governments referred to in this book have their pilot boats conform to the "Revised International Rules for Preventing Collisions at Sea."

Pilot signals—Netherlands, Germany, etc.—The following signals from the International Code for vessels requiring pilots, etc., have been approved and adopted by the Governments of the Netherlands, Germany, Denmark, and Belgium. If used for any other purpose, the person doing so is liable to a fine not exceeding $100.

In the daytime.—(1) The jack or other national flag hoisted at the fore, having a white border around it one-fifth the breadth of the flag; or (2) the pilotage signal P T of the International Code.

Vessels requiring pilots for ports of the Netherlands may make also the following signals, separately or together or with the others, namely: (3) The international signal S, with or without the distinguishing pennant above it; (4) the distance signal, two balls, or objects which resemble them, above a cone with the point upward.

Vessels should also hoist the flags of the International Code constituting the signal appropriate to the port of destination.

By night the signal to be shown by all vessels is: (1) Blue light every 15 minutes; or (2) a bright white light shown at intervals immediately above the bulwarks and visible each time about 1 minute.

Vessels bound to the Texel or Ymuiden should exhibit two vertical lights, red over white.

Those bound to Goeree, Maas, and Brouwershaven, two vertical white lights.

Those bound to the entrances of the Schelde, a red light over two white lights, placed vertically. Pilot boats will reply by same signal.

Netherlands pilot vessels carry the following distinguishing signals when pilots are on board and available for service:

1. All pilot vessels, whether steam or sailing, will be distinguished by a blue flag with a white number on it and will exhibit at night a

white flare-up light every 15 minutes, in addition to the other lights mentioned in the succeeding paragraphs. They will also have a special signal indicating the district or channel to which they belong.

2. Sailing pilot vessels will be distinguished by having their number and name (in full, when possible) of station on the mainsail and on the stern. At night they will show a fixed white light at the masthead.

3. Steam pilot vessels at night will carry the usual side lights (except when at anchor) for a steam vessel and also at the masthead at a height equal to the beam, but at never less than 20 feet, a white light hoisted vertically over a red light, these lights being 6 feet apart and visible in all directions. During fog, mist, falling snow, or heavy rainstorms, when on their stations off the various sea gats, they will give the following signal every 2 minutes: (1), A long blast from a siren, silent interval 1 second; (2), a long blast from the steam whistle, silent internal 1 second; (3), a long blast from a siren, silent interval about 105 seconds.

When a private steamer is employed on the Netherlands coast as a pilot vessel, in the temporary absence of the usual pilot vessel, she will carry as a distinguishing mark by day a blue flag with white number, the same as the regular vessel, and by night the usual lights for a steamer, with the addition of a flare-up every 15 minutes.

Danish pilot steamers, light vessels, etc., when they can furnish pilots, carry on the foremast a red and white flag, upper part white, lower part red, in combination with the national flag astern. When they are not able to furnish a pilot, only the national flag is shown.

Danish pilot (rowing) boats carry the same flag as the pilot vessels.

English pilots for London may be obtained on application by letter or telegram to the ruler of pilots, Gravesend, or to the superintendent of pilots, Dover.

Fishing boats.—Regulations respecting the lights carried by and the signals made from fishing vessels have been agreed to by the Governments of the following countries referred to in this work, viz: Great Britain, France, Belgium, Netherlands, and Germany. These regulations form article 9 of the "Regulations for Preventing Collisions at Sea," and are now in force.

Routes for steamers.—Those bound from Dover Strait to the Baltic or the reverse must bear in mind the constant stream of traffic across their course up or down the North Sea, between the British coast and that of Holland and Germany. The number of sunken wrecks lying near or in the fairway in from 10 to 15 fathoms should alone urge upon seamen the need of the closest vigilance.

Apart from the tidal currents, other currents are uncertain both in direction and strength, and, being sensibly affected by the winds, may at times set directly toward the shore, the safety of vessels, therefore, can in thick weather only be assured by timely use of the lead, and seamen should be prepared, on getting into shallow water, to anchor or stand off the land, as circumstances may require. Reference to the charts shows that by keeping outside the depth of 12 fathoms a vessel would in most cases be in safety, but this does not apply to the approaches to the Texel, where the water quickly shoals from 10 fathoms to the outlying sands.

Those from the Baltic bound for the Humber or the Thames should endeavor to make their landfall, respectively, at Flamborough Head and Lowestoft, where the shores are comparatively free from outlying banks.

Note.—These routes are based on prewar conditions; no change has been made for circumstances that have arisen since the beginning of the war.

Between the Thames and Schelde.—Taking a departure from the Tongue Light Vessel steer (allowing for the tidal current) to pass southward of Fairy Bank and the light vessel marking the southern extremity of the West Hinder; avoid the shoal patch at the eastern part of East Dyck Bank, and steer for Wandelaar Light Vessel; pass southward of it, and up Wielingen Channel into the Schelde. The opposite courses are followed on the return route. The distance from the Nore to Flushing is about 110 miles.

Those from Harwich take their departure from the Sunk Light Vessel thence northward of Long Sand Light Vessel and southward of Galloper Light Vessel. From thence steer to pass southward of North Hinder Light Vessel, and northward of West Hinder Bank to Wandelaar Light Vessel. When there is much sea on, do not pass over the East Hinder, as there it is very heavy, but, after passing the North Hinder, steer southward clear of the East Hinder before shaping course for the Wandelaar.

Between the Thames and Rotterdam.—Taking a departure from the Nore, the route by the southern channels to the mouth of the river is a little shorter than by the Swin; and on the return route the North Foreland is decidedly the better landfall, besides being more free of outlying shoals. Nearly all the steamship traffic from the North Sea to Rotterdam is through the New Rotterdam Canal (Nieuwe Waterweg), about 8 miles off which is moored the Maas Light Vessel, and it is advisable to make the light before closing the entrance to the canal.

The packets from Harwich pass out northward of the Shipwash and Outer Gabbard, and then straight across to the Mass Light Vessel.

Between the Thames and the Jade, Weser, or Elbe.—The departure being taken from Orfordness, a course should be shaped to pass about 15 miles northward of the Texel, which distance from the shore should be maintained until the outer light vessels are recognized, when they may be steered for.

Between the Humber and the Elbe.—The steamships from the Humber for the Elbe pass northward of the Outer Dowsing and steer for the light vessel on Borkum Flat. Strangers should make Helgoland before closing the Elbe.

When returning, and the winds are strong from the northwest quarter, it is usual to pass southward of the Leman and Ower Banks, and from thence to the Humber between the Dudgeon and Outer Dowsing.

Between the Thames and the Skaw.—No detailed directions are necessary for this route in a steamer. It may be useful, perhaps, to draw attention to the set of the currents on the coasts of Jutland and to mention that it is not prudent to pass within a distance of 10 miles from Hirshals in a vessel of deep draft.

Sailing routes—From the Thames to the Skaw.—As the banks in the North Sea occupy large portions of ground, somewhat shoaler in general than the parts surrounding them, soundings when carefully taken, tend materially to assist in verifying the vessel's position. When navigating from port to port the seaman will have to consider the force and direction of the wind, the tides, and his proximity to the land. The routes given for steamers should be followed so far as the winds will admit of.

Those from the Thames bound for the Skagerrack may pass between the Shipwash and Galloper Sands, or, if from the Downs, between the latter and Kentish Knock, and gain the open sea either eastward or westward of the Gabbard Sands, according to circumstances.

Those eastward of the Goodwin, after passing the North Goodwin Light Vessel at a distance of about 3 miles, and nearly midway between it and the Falls Tail, should steer to pass between the Drill Stone and the Falls Head, about 5 miles eastward of the Kentish Knock Light Vessel, and 3 miles westward of that of the Galloper. The depth of water in this track will be from 27 to 17 fathoms, and the direction of the tidal current nearly in the same line. Those whose draft will admit of crossing the shoal parts of the falls may, with attention to the lead, skirt this ridge close up to the Galloper, as it is steep-to on either side; but if of heavy draft they should be careful to avoid the shallow parts.

When working to the northward, eastward of the falls, be careful to avoid the Sandettie, on which are strong ripplings, and in fresh breezes a heavy sea, which breaks on the shoalest part. Further northward do not stand eastward of a line joining the Fairy and North Hinder Banks; and it will be prudent for those of deep draft to pass about 3 miles northward of the light vessel to avoid the shallow part of the latter bank. At about 4 miles eastward of the Galloper steer to cross the parallel of 53° N., and about midway between Brown Ridge and Smiths Knoll.

As the depths over Brown Ridge and those eastward of it are from 11 to 15 fathoms, with deeper water between and immediately eastward of them, by attention to the lead they form an excellent guide when in this vicinity.

Cross the parallel of 54° N. eastward of the Outer Silver Pit, at the south end of the Dogger Bank.

About 20 miles northward of the northeast end of the Dogger Bank, on the parallel of 56° N., and about 120 miles from the coast of Jutland, is the 30-fathom curve. In all cases it is better to keep well to the westward to counteract the effect of any easterly set, as the coast of Jutland, though distinguished by large beacons in places, is low, and not always seen until near to it. If necessary, it may be avoided by skirting the 30-fathom line, which curves round Hanstholm Lighthouse at a distance of nearly 20 miles.

To the Elbe, etc.—During northerly winds and thick weather use the utmost caution in rounding the Texel and the low islands east-eastward of it, on no account coming into less than 12 fathoms, and also pass outside Borkum Flat in about 18 fathoms, soft muddy bottom; and it may be well to " heave to " at about 20 miles from Helgoland, which at any rate should be sighted before closing the Elbe.

Sailing vessels bound from the Skagerrack to the Thames should steer well to the northward, keep the Skagerrack open, and avoid the coast of Jutland. When working, stand toward the coast of Norway, and not southward of the edge of the bank of soundings, until as far westward as the Naze, as the current near this part of the coast of Norway sets to the westward, but does not extend far from the land. After passing the Naze the seaman will soon perceive the effects of the current, and must act according to the direction and force of the wind. Be careful not to stand southward of Bovbierg with a northwest wind, in order to avoid the Horn Reefs.

In winter, seamen are strongly recommended to make the coast of Yorkshire somewhere about Flamborough Head, thus avoiding the Yarmouth Sands, and having a good departure to clear the Leman and Ower.

As the 30-fathom curve trends from the entrance of the Skagerrack in the direction of Flamborough Head, it is an excellent guide to those taking this route. By not going to the sounthward into a less depth, or to the northward into a greater depth, Flamborough Head will be made.

Those in vessels of heavy draft, however, commonly steer outside the Leman and Ower Light Vessel, and make the land between Lowestoft and Orfordness, where the soundings are regular and the shore can be approached to a prudent distance. When approaching the coast of Norfolk, should soundings be obtained on Swarte or Broken Banks, they will indicate proximity to the Leman and Ower, when a sight of the light vessel stationed on the latter bank may be obtained; and further to the southwest, in 24 to 26 fathoms of water, be careful when standing to the westward, until to the southward of Smiths Knoll.

CHAPTER II.

NORTH SEA, SOUTHERN PORTION—OUTER BANKS—DUNKERQUE TO THE SCHELDE.

Banks off the north coast of France and Belgium—General remarks.—The approach to the low and dangerous coast between Calais and the Schelde River is obstructed by numerous banks of gray and black sand, which extend 15 miles from the shore on the meridian of Calais and 42 miles in a northeasterly direction from Dunkerque. They are all long and narrow and converge in direction toward Dover Strait. Their shoalest parts may be touched upon by vessels of almost any draft, and the eddies they occasion cause a hollow sea, which breaks when it blows hard. Those farthest from the land lie on the eastern side of the 20-fathom curve, which, in the southern part of the North Sea, is the eastern limit of the fairway to Dover Strait.

The rise of the tide over the outermost of these banks may not exceed a few feet.

The banks are all steep-to on their inshore or southeastern edge and extend with a gentle slope toward the northwest, and as they rise from a bottom of sand, gravel, and broken shells, on which there is everywhere a less depth than 20 fathoms, the simple precaution of not going into less than 20 fathoms insures keeping outside all these banks. The lights at Cape Gris Nez and Calais are in a good position to point out at night their western limit. The main light at Dunkerque in clear weather gives notice of approach to the greater part of them, and the navigation is still further facilitated by the two light vessels (temporarily withdrawn in 1918), moored within the Hinder Banks, by the light vessel (temporarily withdrawn in 1918), moored on the northwest side of the Sandettie Bank, by that (temporarily withdrawn in 1918), northeastward of the Ruytingen and by others more inshore. The dangers of the inshore navigation can only be avoided by placing the vessel in charge of a pilot, for the banks are all so liable to changes in their formation that no description of them can be considered permanently reliable. Generally speaking, none of the banks should be approached except a vessel is bound for one of the harbors on the coast.

The banks are divided into two groups, those nearest the shore, eleven in number, being named the Dunkerque Banks; others, six in number, lying some distance from the coast and northward of the Dunkerque Banks. They are the Fairy, North Hinder, West Hinder, East Hinder, and Bligh Banks and Thornton Ridge.

Dunkerque Banks, eleven in number, extend 15 miles from the coast between the meridians of Calais and the frontier of Belgium. Of these the outer ones only will be described in this work.

Caution.—The buoys marking the outer banks are very liable to drift from their charted position during gales, but they are replaced as soon as possible. Many of the buoys and light vessels referred to below are not in position but will probably be replaced when war ends.

Sandettie is the outer and westernmost of the Dunkuerque Banks; it is 12½ miles in length in an easterly and opposite direction, its breadth varying from 800 yards to 1 mile. Its southern and southeastern edges are steep-to, but its slope is more gradual toward the northwest, and this side may be easily avoided by the lead.

There are two ridges on this bank over which it is dangerous to pass in bad weather. The western ridge has a patch of 3¼ fathoms, with Calais Lighthouse, bearing 188°, distant about 15.3 miles. The center of the eastern ridge, with 3½ fathoms, lies about 3.3 miles, 64°, from the 3¼ fathoms. On other parts of the bank the depths vary from 6 to 9 fathoms.

The Sandettie, rising suddenly from comparatively deep water, causes strong ripplings, and with a fresh breeze the sea is heavy around it and breaks on the ridges.

From the southwestern end of the bank, which is steep-to, Cape Gris Nez, Calais, South Foreland, and other lights are visible in clear weather.

In the daytime in clear weather the summit of Mount Couple to the southward, the South Foreland, and the white cliffs near Dover may be recognized.

Sandettie Light Vessel, from which is exhibited a flashing white light, at an elevation of 39 feet above the sea, visible 11 miles, is moored in a depth of 12 fathoms to the northwestward of the western shallow ridge of the Sandettie Bank, in latitude 51° 13′ 30″ N., longitude 1° 53′ 45″ E. The light vessel has a military mast in the center, is painted red, and marked "Sandettie" on each side.

An anchor light is also shown from forward, to indicate the direction of the current.

Fog signal.—During thick or foggy weather a fog siren is sounded.

Submarine fog bell.—During thick or foggy weather a submarine fog bell is sounded on board the Sandettie Bank Light Vessel.

Caution.—As vessels have often come into collision with this light vessel by endeavoring to pass ahead of her, mariners are cautioned to pass astern and not ahead of this light vessel, for the tidal current runs at a velocity of 2½ to 3 knots past her at springs.

Outer Ruytingen, midway between the coast of France and the Sandettie, is separated from the latter by a channel from 5 to 6 miles wide, with depths of 15 to 20 fathoms. Its western end is about 7 miles from the shore, ¾ mile westward of the meridian of Calais Lighthouse; from thence, within a depth of 10 fathoms, it extends about 19 miles east-northeastward to about a mile beyond the position of the light vessel.

The bank rises steeply from the bottom on its southeastern side, but with a gentle slope northwestward. Those parts on which there are less than 5 fathoms form two ridges, with a channel of from 6 to 8 fathoms and 2 miles wide between them; from the center of this channel, Gravelines Lighthouse bears 140°, and Calais Lighthouse 216°.

The western ridge has a least depth of 1¾ fathoms, and within the depth of 5 fathoms is 3½ miles in length.

The eastern ridge within the 5-fathom curve is 9 miles in length, with depths of from 2 to 3 fathoms in places.

The bank causes strong tide rips, and with a fresh breeze the sea breaks on the shoalest parts, and is heavy on its edges. There are irregularities of bottom extending some distance westward of this bank, and those in small vessels should avoid crossing them in bad weather on account of the high sea they occasion.

Shoal.—A shoal of 3 fathoms is situated 306° from Dunkerque Leughenaer Lighthouse, distant 13.2 miles.

Buoys.—Three buoys mark the northwestern side of the eastern ridge of the Outer Ruytingen Bank, viz:

Northeast Buoy, No. 1, is a black spindle buoy surmounted by a cylindrical topmark, in 10 fathoms, at ½ mile 278° of the north end of the ridge, with Dunkerque Lighthouse bearing 139° distant 12 miles.

Middle Buoy, No. 3, black, conical, with staff and cylinder, in 6 fathoms, 4 miles 222° from Northeast Buoy.

Southwest Buoy, No. 5, black, conical, with staff and cylinder, in 8 fathoms, ½ mile northward of the western end of the eastern ridge, 241° 30′ nearly 4 miles from Middle Buoy.

Three buoys also mark the western ridge or the Outer Ruytingen Little Bank, viz:

North Buoy, No. 2, is a red spindle buoy, with staff and cone, point upward, in 6½ fathoms about 2.3 miles 272° 30′ from No. 5 Buoy.

South Buoy, No. 4, red, conical, with staff and cone, point upward, at the southeast extremity of the ridge, lies in 11 fathoms, 1½ miles 201° from No. 2 Buoy.

West Buoy, No. 7, is a black conical buoy, with staff and cylinder, in 6 fathoms, about 2½ miles westward of No. 4 Buoy, with Calais Lighthouse bearing 182° 30′, distant 7.5 miles.

Caution.—Mariners are cautioned not to place implicit trust in these buoys maintaining the assigned positions, for, in addition to the liability of their being drifted from their positions by the sea, they are especially in the autumn months, often fouled by the nets of the fishing craft which frequent these waters in considerable numbers.

Ruytingen Light Vessel.—About 1 mile westward of the northeast end of the Outer Ruytingen, and in 10 fathoms, is moored a light vessel, from which a flashing red light is exhibited, at an elevation of 39 feet above the sea, visible 11 miles.

The vessel is painted with red and black alternate streaks, with "Ruytingen" in white on the sides, carries a red cage at the masthead, and lies with Gravelines Lighthouse bearing 195°, and nearly in line with Dyck Light Vessel. A line gun is carried for rescue purposes.

A white spindle mark buoy lies 550 yards southwestward of the light vessel.

Fog signal.—In thick or foggy weather a siren is sounded. In case of accident to the siren a bell is sounded in a similar manner.

Tidal currents.—The approximate velocity and direction of the currents at the Ruytingen Light Vessel are as follows:

Time of tide at Dover.	Tidal current at light vessel.
5 hours before high water	WSW. from ½ to 1½ knots.
4 hours before high water	SW. by S. from ½ to 1½ knots.
3 hours before high water	SW. by S. from ½ to 1½ knots.
2 hours before high water	SSW. from ½ to 1½ knots.
1 hour before high water	S. from 0 to 1 knot.
High water at Dover	NE. by E. from 0 to 1 knot.
1 hour after high water	NE. from ½ to 1½ knots.
2 hours after high water	NE. from ½ to 1½ knots.
3 hours after high water	NE. by N. from ½ to 1½ knots.
4 hours after high water	NNE. from ½ to 1 knot.
5 hours after high water	NNE. from ½ to ¾ knot.
6 hours after high water	Slack.

Inner Ruytingen.—The body of this bank lies 2½ miles eastward of the northern part of Outer Ruytingen, and, within a depth of 5 fathoms, it is 6 miles in length in an east-northeast and opposite direction, with a maximum breadth of 2 miles. The shoalest water, 1½ fathoms, is near its south end, but there are patches of 2½ and 3 fathoms near its north extremity and other patches southward of the bank within the 10-fathom curve. Its irregular depths cause an uneasy sea.

The channel between Inner and Outer Ruytingen has a least depth of 8 fathoms. Gravelines Light and Ruytingen Light Vessel are sufficient marks for its safe navigation.

Bergues Bank.—The west extremity of this bank lies 2 miles eastward of Ruytingen Light Vessel, and within a depth of 10 fathoms is 7 miles in length. It has general depths of 6 to 8 fathoms, but toward its western end is a ridge with 3¾ fathoms, with Ruytingen Light Vessel 250°, distant nearly 4 miles. With a fresh breeze against the tidal current there is a considerable sea over the bank.

East Dyck Bank, or Clif d'Islande, lies 1 to 1½ miles eastward of the Bergues and Inner Ruytingen Banks, the depth between being from 12 to 17 fathoms, except toward the southwest, where a ridge of 6 to 8 fathoms connects the East Dyck and Inner Ruytingen. The bank is 15 miles long, northeast and southwest, from ¾ to 2.3 miles broad, and has three ridges, the middle one of which is 4.3 miles in length with 2 to 3 fathoms of water. The northern ridge is 3 miles long, with 1¾ fathoms least water, and the southern has two patches of 1 fathom, 1.3 miles apart. These ridges are separated by depths varying from 2¾ to 5 fathoms.

The bank is dangerous throughout its whole extent, as it rises abruptly from depths of 11 to 17 fathoms, particularly on the southeast side, as is the case in nearly all these banks.

The northeastern end of East Dyck is especially to be guarded against. Here the depths are only from 3 to 4 fathoms and the sea is always disturbed around it, as it rises abruptly from the depths of 12 and 16 fathoms and is therefore more difficult to be avoided by the lead. From the spot of 3 fathoms West Hinder Light Vessel bears 298° distant 3½ miles, and Ostende Lighthouse 114° distant 16½ miles; but, this end of the bank being so far from the land, the most remarkable objects can be recognized (even from the masthead) only in very clear weather.

Outer Ratel, situated southeast of and parallel to East Dyck, is 9 miles in length within the depth of 5 fathoms, with depths of 1.3 to 2½ fathoms over the greater portion of it. Its name, meaning "rattle," is perhaps derived from the noise caused by the heavy sea on it in bad weather.

The Outer Ratel ought not to be crossed, even by small craft, without the calmest of weather. It is separated from East Dyck by depths of 7 to 12 fathoms.

A bank about 1.3 miles in length, with 4¼ fathoms water, lies midway between its north extremity and that of East Dyck.

East Breedt Bank is a continuation northeastward of Smal Bank, mentioned below. Within the 3-fathom curve it is 3 miles in length, with charted depths of 2¼ to 2¾ fathoms. It lies east-southeastward of and parallel to the northeastern part of Outer Ratel Bank, the distance between the 5-fathom curve of the banks being about 1 mile and the depth in mid-channel 11 to 14 fathoms. Depths of less than 5 fathoms extend 2 miles northeast of it, and its south end is connected by a ridge with Smal Bank, with from 4¾ to 5 fathoms over it.

Smal Bank.—The western end of this bank lies 1½ miles northward of Dunkerque Pier and extends about 15 miles east-northeastward nearly to East Breedt Bank, above mentioned. The southeastern horn of it continues 5 miles farther, nearly to Ostende, and is known as Nieuport Bank. The western half has only from 1 to 6 feet and is dry in one spot, with depressions in places. The eastern half has several patches of 4 to 6 feet of water, with depths of 1½ to 2¼ fathoms toward the northeast end of the bank. The southeast horn has 2 to 3 fathoms. The bank is steep-to in places on its southeast side.

Smal Bank is joined to Hills Bank, inshore of it, by a bar with 2 fathoms of water.

Banks north of Dunkerque Banks.—These banks are dangerous, not only from their shallowness and their being so liable to change in form that anything but the latest charts may be very misleading, but also from their being at so great a distance from the shore that the position of a vessel is not always accurately known with regard to them and that they lie directly in the route of vessels bound for the Schelde. There is but a slight rise of tide on these banks.

Fairy Bank (lat. 51° 25' N., long. 2° 20′ E.), a sand bank with from 3¾ to 10 fathoms of water, is situated on the eastern side of the deep fairway northeastward from Dover Strait, with a channel between it and West Hinder about 2½ miles wide. From its southern end, as charted, Dunkerque Lighthouse bears 170° 18 miles, and West Hinder Light Vessel 73° distant 6½ miles. From thence it extends northeastward nearly 10 miles, its greatest breadth not exceeding 1,600 yards.

There are two ridges shown on this bank; that near the middle, with less than 5 fathoms of water, is 2½ miles in length, and from its shoalest spot of 3¾ fathoms Dunkerque Lighthouse bears 177°, 22 miles. The other ridge, with 5¼ fathoms, is near the northern end of the bank. Dunkerque Light is visible in clear weather from the southern end of Fairy Bank.

A bank about 8 miles in length, with from 6½ to 10 fathoms of water, lies 1 mile westward of and nearly parallel with Fairy Bank.

Wrecks.—A wreck is charted in about 18 fathoms in a position 254°, 7.8 miles from the West Hinder Light Vessel and 1.3 miles westward of the southern extremity of Fairy Bank, and another in the same depth 302°, 10½ miles from the same light vessel.

North Hinder, a dangerous shifting sand bank, situated northeastward of Fairy Bank, is charted about 7 miles in length north-northeast and south-southwest and from 1,000 to 1,600 yards in breadth, with depths under 10 fathoms. It is probably of much less extent than is shown on the chart. On its southern part a narrow ridge, with 4 fathoms and possibly less, extends 2½ miles southward from about the middle of the bank, steep-to on its eastern side. From the northern end of the bank, as charted, Galloper Light Vessel bears 274°, distant 25 miles.

Between and within North Hinder and Fairy Banks are several banks with from 8 to 10 fathoms of water.

North Hinder Light Vessel is moored in about 17 fathoms 1¼ miles eastward of the southern end of the shallow part of North Hinder Bank. From the main masthead is exhibited, at an elevation of 46 feet (30 in bad weather) above the sea, a group flashing white light, visible 12 miles.

The vessel has two masts, is colored red with a white streak, and has the name "Noord-Hinder" on her sides.

If the apparatus of the light is out of order, a fixed white light will be exhibited in lieu of the flashing light and a white flare light will be shown every 10 minutes just above the bulwarks.

If the light vessel is out of position, neither the flashing light nor the usual riding light will be shown, but red lights will be exhibited at bow and stern. By day a red flag is shown at the mizzenmast head.

A gun, followed by a rocket at night, denotes that assistance is required on board the light vessel.

Fog signal.—During thick or foggy weather a siren is sounded. If the siren is disabled, a bell is struck.

Submarine fog bell.—The North Hinder Light Vessel has been furnished with a submarine fog bell. Should the bell be working for practice with passing vessels the signal Z N Q will be hoisted.

Signals.—The light vessel is telegraphically connected with the shore, and messages from and to passing vessels, conveyed by flag signals, are received and sent.

Only in cases of urgent necessity are vessels allowed to communicate by wireless telegraphy. Call letters N H D.

Storm signals, in accordance with the Netherlands system, are shown from the light vessel.

Watch buoys.—A red can buoy is moored at a distance of about 650 yards 347° from the light vessel.

Tides.—It is high water, full and change, at North Hinder Light Vessel at about 0 h. 0 m., one hour earlier than at Flushing; the mean rise and fall is 7¾ feet.

Tidal currents.—The approximate mean direction and velocity of the tidal currents at North Hinder Light Vessel are as follows: The maximum observed for the northgoing current was 2¼ to 3 knots, and for the southgoing current 2¼ to 2¾ knots, at both the Hinder Light Vessels. The strength is naturally much affected by gales.

Time of tide at Dover.	Tidal current at light vessel.
6 hours before high water	W. by S., turning to SW. by S., from ¼ to ½ knot.
4 hours before high water	SW. by S. from ½ to 1 knot.
3 hours before high water	SSW. from 1 to 1½ knots.
2 hours before high water	S. by W. from 1 to 1¼ knots.
1 hour before high water	S. by W. from ¾ to 1¼ knots.
High water	Turning, S. by E. to E. by N., from ¼ to ½ knot.
1 hour after high water	Turning, E. by N. to NE. by N., from ¼ to ½ knot.
2 hours after high water	NE. by N. from ¾ to 1¼ knots.
3 hours after high water	NNE. from 1 to 1½ knots.
4 hours after high water	N. by E. from 1 to 1¼ knots
5 hours after high water	N. by E. from ½ to 1 knot.
6 hours after high water	N. by W., turning to W. by S., from ¼ to ½ knot.

West Hinder, a sand bank, charted, about 14 miles in length in a northeast and southwest direction, within the 10-fathom curve, and from 1,400 yards to 1.3 miles wide, lies eastward of Fairy Bank and southward of North Hinder. A narrow ridge forms the center of the bank, extending its whole length, with depths of from about 2¾ to 4 fathoms. By daylight the bank may generally be discerned by the tide ripples over it, but the lead should be kept carefully hove when approaching any of these banks.

The only passage practicable for deep-draft vessels bound to Flushing from the westward and intending to enter the Schelde by the Wielingen Channel is between the outer Ruytingen, Bergues, and East Dyck on the one side and the Fairy and West Hinder on the other.

West Hinder Light Vessel (lat. 51° 22′ N., long. 2° 27′ E.).—Near the southern end of West Hinder Bank, and on its eastern side, in 17 fathoms, is moored a light vessel from which is exhibited, at an elevation of 40 feet (33 in bad weather) above the sea, an occulting alternating white and red light, visible 12 miles.

The vessel is painted black with a red streak, with the name "West Hinder" on her sides, and carries a conical framework at the masthead.

Should the light be out of order, it will be replaced by two fixed lights, vertical, the upper red, the lower white, and a white flare light will be shown every 10 minutes. Should the light vessel drift from her station, the occulting light will be replaced by three fixed lights, vertical, the center light red, the other two white; by day, in this latter case, a red flag will be hoisted at the mainmast head. Should the light vessel require assistance by day, the flags N C of the International Code will be shown; by night, in addition to the distinguishing and riding light, a white light will be shown at the taffrail and a red rocket will be fired every 15 minutes.

Fog signal.—During thick or foggy weather a siren is sounded. If siren is disabled, a bell is sounded in a similar manner.

Submarine fog bell.—The West Hinder Light Vessel is furnished with a submarine fog bell.

Watch buoys.—Two conical buoys, painted in red and black horizontal stripes, are moored each at a distance of 550 yards from the light vessel, to enable the vessel to be put back in position should she break adrift; one buoy, marked "W. H. 1," on the bearing 278°, and the other, marked "W. H. 2," on the bearing of 8° from the light vessel.

Tidal currents.—The approximate direction and velocity of the currents at the West Hinder are as follows:

Time of tide at Dover.	Tidal current at light vessel.
5 hours before high water	SW. by W. from ½ to ¾ knot.
4 hours before high water	SW. by W. from ¾ to 1¼ knots.
3 hours before high water	SW. by W. from 1 to 1¾ knots.
2 hours before high water	SW. by W. from 1 to 1¾ knots.
1 hour before high water	SW. by S. from ½ to 1¼ knots.
High water at Dover	S. by E. to SE. by E. from ¼ to ½ knot.
1 hour after high water	NE. by E. from ½ to 1 knot.
2 hours after high water	NE. by E. from 1¼ to 1¾ knots.
3 hours after high water	NE. by E. from 1½ to 2 knots.
4 hours after high water	NE. by E. from 1 to 1½ knots.
5 hours after high water	NE. by E. from ½ to 1 knot.
6 hours after high water	NW. by N. to W. by S. ¼ knot.

East Hinder (lat. 51° 34′ N., long. 2° 40′ E.), a sand bank charted about 9½ miles in length, in a northeast and southwest direction, and 1,200 or 1,400 yards wide within a depth of 10 fathoms, lies about 3½ miles eastward of North Hinder. It has three or more ridges, with depths of from 3¾ to 5 fathoms and 6 to 7 fathoms between them. The bank is steep-to on both sides and separated from North Hinder by a channel 3 miles wide, with from 15 to 20 fathoms, and from West Hinder by a channel 1.7 miles wide, with 14 to 18 fathoms.

About midway between the southern end of East Hinder and the East Dyck there is a narrow bank 4.3 miles in length, with from 5 to 8 fathoms of water.

Bligh Bank, of sand, is charted 10 miles in length, from ½ mile to 1.3 miles in width and lies from 1½ to 2½ miles eastward of and nearly parallel to East Hinder.

This bank is steep-to and has irregular depths of from 4¾ to 10 fathoms, the least depth being charted in latitude 51° 35′ 30″ N., longitude 2° 45′ 15″ E. There is a 5¼-fathom patch at the southern extremity; also a 5-fathom patch near the northern end of the bank, with a patch of 9 fathoms at 2½ miles northward of it.

Thornton Ridge, situated about 9 miles southeastward of Bligh Bank, is about 3 miles in length by ½ mile in breadth within the 5-fathom curve, with depths of 2 to 3 fathoms in places. From the shoalest part of 2 fathoms Ostende Lighthouse bears 185° 30′ distant 19 miles. The general depths on the surrounding bank, which extends about 3½ miles northeast and 8 miles southwestward, are from 6 to 10 fathoms.

The land in the neighborhood of West Kapelle and the lights of West Kapelle and of Ostende may be seen from this ridge in clear weather.

Banks with depths of 8 to 10 fathoms lie between Thornton Ridge and Bligh Bank.

The Rabs, with a least depth of 4 fathoms, lie about 4½ miles east of the north extremity of Thornton Ridge, with depths of 7 to 12 fathoms between.

The Schar, with depths of 7 to 8 fathoms, lies about 6 miles 20° of the Rabs. There are several banks similar in character to the northeastward, as shown on the chart. To the eastward of the Schar is Schouwen Bank, the outermost of those in the approach to the Schelde.

Coast.—Zuidcoote village is situated about 4 miles eastward of Dunkerque, from ½ to ¾ mile back from the shore. The coast between is low and formed of sand hills and presents nothing remarkable between the Casino of Malo les Bains and the semaphore of Zuidcoote, except the Tente Verte Beacon, of wood, with a cone surmounted by a ball as topmark. Northeast of the Tente Verte is a coast guard station and battery. The sand dries off this shore to the distance of 670 yards.

Semaphore.—The semaphore erected on the old tower at Zuidcoote is 33 feet high and 124 feet above the sea.

Braye-dunes village lies 1½ miles eastward of the semaphore; and the village of Ghyvelde, the clock tower of which is visible from the offing, is 1 mile within it.

Coast of Belgium—Aspect.—The coast from the frontier of France and Belgium, about 7 miles east of Dunkerque, to Ostende, is skirted by sand hills of varying height, but none are of so marked a character as to distinguish it from the others, and thus to serve as a guide for identifying the shore from the offing. The most useful objects for this purpose are the under-mentioned churches.

Nieuport (lat. 51° 08′ N., long. 2° 45′ E.) lies 15 miles east of Dunkerque. The intermediate land is all low, with hummocks of sand along the shore and several churches appearing in the background: Leffrinckoucke Church, with a spire; Zuidcoote, nearer the sea, with a steeple; Ghyvelde, 1½ miles southeastward of Zuidcoote, with a square tower, all in French territory and to be seen at a distance of 15 miles; Furnes, with its two spires of different heights, and Wulpen with one spire, in Belgium may be easily recognized. Near the coast northward of Furnes is a long white sand hill named Brours Duin, which is a little more elevated than the adjacent hills and may be known by its barren appearance. Two miles farther west is the storm signal station at La Panne.

Nieuport has several steeples and windmills. The great church tower with its turret shows conspicuously among them; also the towar of the market hall and the lighthouse. In clear weather these buildings can be seen 12 to 14 miles.

From the entrance to Nieuport the land trends eastward for 9 miles to Ostende, the coast being all low sand hills. In the intermediate space are several churches: Lombartzyde, with a high flat tower, about 1 mile northeast of Nieuport; Westende Church has a spire; and Middelkerke a high white tower surmounted by a spire, which shows well above the sand hills; Mariakerke with a small tower topped by a short spire is only now and then visible.

Ostende stands close to the shore, and is very prominent from the offing. Among its principal objects are the tall tower of its cathedral, which is surmounted by twin spires; the lighthouse; and the high square tower of the town hall.

La Panne.—The Belgian village of La Panne is situated about 1½ miles eastward of the frontier.

A lifeboat is stationed at La Panne, and there is also a storm-signal station for fishing craft.

La Panne Pass.—This pass is reported to have had a least depth of 9 feet in March, 1916.

Light and bell buoy.—A red light and bell buoy, marked "Broersbank," exhibiting an occulting white light every 10 seconds, is established in a depth of 2 fathoms on the eastern edge of the bank on the western side of this pass, with La Panne Light Post bearing 200° distant 1.1 miles.

Light buoy.—A black light buoy, with framework superstructure marked "Bk. Den Oever," exhibiting an occulting red light every 10 seconds, is situated on the western edge of Den Oever Bank, in a depth of 2¾ fathoms, at 1.7 miles 31° of La Panne Light Post.

West Deep—Light and whistle buoy.—A black light and whistle buoy, surmounted by a ball marked "Traepegeer Bk.," is established on the northern edge of Traepegeer Bank, at a distance of 2.3 miles, 323° of La Panne Light.

This buoy exhibits a group occulting red light, showing a group of two eclipses every 22 seconds—thus: light 10 seconds, eclipse 5 seconds, light 2 seconds, eclipse 5 seconds.

Fishing light.—At La Panne, on a sand hill a fixed red light is exhibited for fishing boats. It is 66 feet above high water and visible 6 miles.

Rescue stations—Lifeboats.—La Panne, Nieuport, Ostende, Blankenberghe, and Knocke are lifeboat stations. The station at Leffrinckouke is furnished with lines only.

Storm signal stations.—The above-mentioned lifeboat stations, also Heyst, are storm-signal stations.

Off-lying banks—Middelkerke Bank (lat. 51° 17′ N., long. 2° 43′ E.) is 3.5 miles within the East Breedt Brank (previously described), with North Channel between. It is 5 miles in length northeast and southwest, within the depth of 5 fathoms; the least water, 2½ fathoms, is about ½ mile from the southwestern end of the bank or shoal, with Nieuport Lighthouse bearing 172°, distant 6½ miles.

Light and whistle buoys.—A red light and whistle buoy, marked "Middelkerke Bk.," surmounted by a cylindrical topmark and exhibiting an occulting white light every 10 seconds, is established in a depth of 5½ fathoms on the northwestern edge of this bank, with Ostende Lighthouse bearing 98° 30′, distant 9 miles.

A black light and whistle buoy, with truncated cone topmark, marked "Middelkerke Bk.," exhibiting an occulting red light every 10 seconds, has been established at the southwestern end of this bank, in a depth of 6¼ fathoms, with Nieuport Lighthouse bearing 163°, and Ostende Lighthouse bearing 99°..

The whistle has a hight note.

Ostende Bank, between Middlekerke Bank and the outer road of Ostende, is within the depth of 5 fathoms, about 6½ miles in length, by ½ mile to 2 miles in breadth, with depths of 2½ to 3 fathoms in places, but over a considerable portion 3¼ to 3½ fathoms may usually be reckoned upon.

Light and whistle buoys.—A red and white vertically striped light and whistle buoy, with lozenge-shape topmark marked "Oostende Bk.," exhibiting a group occulting red light, showing a group of two eclipse every 22 seconds—thus: light 10 seconds, eclipse 5 seconds, light 2 seconds, eclipse 5 seconds—has been established on the western edge of this bank, in a depth of 6¼ fathoms, with Ostende Lighthouse bearing 114°, distant 5.4 miles.

The whistle has a low note.

A black and red vertically striped light and whistle buoy, surmounted by a Latin cross, marked "Oostende Bk.," and exhibiting a group occulting white light every 22 seconds—thus: light 10 seconds, eclipse 5 seconds, light 2 seconds, eclipse 5 seconds—is established in a depth of 4¼ fathoms, on the eastern edge of Ostende Bank, with Ostende Lighthouse bearing 132°, distant 4.5 miles.

Caution.—A heavy breaking sea rolls over Middelkerke and Ostende Banks during northerly gales and alters the position and depths of the shoal patches.

Wenduyne Bank begins about 2½ miles eastward of Ostende Bank and, lying nearly parallel to the shore, extends to abreast Blankenberghe, or about 7 miles. The bank has from 2¼ to 3 fathoms upon it, and its western end partly shelters Ostende Outer Road from northeasterly winds.

A buoy, with red and white vertical stripes and surmounted with a white ball, is moored in 3¾ fathoms on the outer side of the center of Wenduyne Bank, nearly 4.5 miles 294° from Wenduyne Church.

A 2¾-fathom patch lies about 700 yards northeastward of the buoy.

Nieuport Bank, lying directly off and partly protecting Nieuport Road, between Middlekerke and Stroom Banks, is the continuation eastward of Smal Bank. It is a narrow ridge with less than 3 fathoms, the least water being about 2 fathoms. From the northeast end of the shoal Nieuport Lighthouse bears 193°, distant 5.3 miles.

Buoys.—A light and bell buoy, painted in red and white horizontal bands and exhibiting a fixed white light, is moored in 5½ fathoms on the southwestern edge of Nieuport Bank, about 4¼ miles 284° from Nieuport Lighthouse and about 3 miles offshore.

A black conical buoy, with staff and ball, is moored about 1,350 yards from the bank, on its north side, nearly abreast the center; from it Nieuport Lighthouse bears 155°, distant nearly 4 miles.

Stroom Bank, which protects Ostende Inner Road and, in a less measure, Nieuport Road, extends the entire distance between Nieuport and Ostende, merging into the shore bank eastward of the latter place. It is a narrow sandy bank, with depths of from 1 to 2 fathoms, on a ridge extending nearly its whole length and subject to change. Its southern side is steep-to.

Channels have been dredged through it, as described below. Its western end is separated from Nieuport Bank by Northeast Channel, which is ½ mile wide, with a least depth of 3¾ fathoms.

Stroom Bank—Light and whistle buoy.—A black and red horizontally striped light and whistle buoy, with spherical topmark marked "Stroom Bank," exhibiting an occulting white light every 10 seconds, has been established on the northern edge of this bank, in a depth of 4¼ fathoms, at a distance of 2.9 miles, 285°, from Ostende Lighthouse.

The whistle has a high note.

Light and bell buoy.—A red light and bell buoy, exhibiting a group occulting white light showing a group of two eclipses every 22 seconds—thus, light 10 seconds, eclipse 5 seconds, light 2 seconds, eclipse 5 seconds—is situated at the eastern end of Stroom Bank in a position 1¼ miles, 282°, of Ostende Lighthouse.

Nieuport Road and West Deep extend from Zuidcoote Pass to Ostende Road, and are together about 12 miles in length and from ½ to 1 mile in breadth with depths over 5 fathoms. They are in some measure protected by the shallow banks to seaward and afford anchorage in depths of 5 to 9 fathoms, good holding ground of mud and sand.

Depths.—There are four passages into Nieuport Road, but, inclosed as it is by banks, they can only be used at low water by small vessels. That from the westward is Zuidcoote Pass, with about 2 fathoms, in continuation from Dunkerque Road; that from the northward through North Channel and over Nieuport Bank in about 2½ fathoms; that from the northeastward through Northeast Channel, between Nieuport and Stroom Banks, in about 4 fathoms; and that from the eastward by the dredged channels over Stroom Bank leading to Ostende.

Directions.—When proceeding to Nieuport Road from Dunkerque Road it is necessary to use Zuidcoote Pass, which is reported to have a low-water depth of about 12 feet, subject to change, but marked by buoys on the French uniform system. Having cleared the Zuidcoote and being northward of the eastern black light and whistle buoy on the south side of West Deep, course may be shaped for Nieuport Road, keeping the southern side of the fairway. Vessels beating up should not stand too far toward the Smal and Nieuport Banks, as they are steep-to.

The approach to Nieuport Road from the northward being through North Channel and over the flat which joins Smal and Nieuport Banks is but little frequented on account of its liability to change and the distance of the passage offshore rendering it difficult to distinguish objects that may be used as marks. Vessels of light or moderate draft sometimes leave the road by it at the top of the tide, and then it is usual to cross the western part of the Nieuport Bank, with Nieuport Lighthouse in line with Templars Tower 149° in about 4½ fathoms at high-water neaps, westward of the black buoy, thence out through North Channel.

Northeast Channel between the Nieuport and Stroom Banks has a depth of 4 fathoms in the fairway over its bar. The dredged channels over Stroom Bank are now available for vessels leaving Ostende.

Anchorage may be taken up with the jetty heads at Nieuport bearing 121°, distant 1.3 miles, in a depth of 4½ to 5 fathoms, sand and mud. Small craft may go nearer to the jetty.

Nieuport.—Nieuport is situated near the outlet of the Yser. Its population, amounting to about 3,000, is principally employed in brewing, distilling, the manufacture of rope and sailcloth, shipbuilding, and fishing. There is railroad communication with Ghent.

The harbor is small and only fit for small craft.

Depth on the bar.—The entrance to the channel is sheltered and kept open by two pile jetties, which confine and direct the water from the river. On the bar, which is 200 yards outside the jetty heads, there is a depth of 1 foot at low-water springs, and 17 feet at high-water springs, subject to variation.

The depths are signaled.

Nieuport Light is group occulting white, elevated 98 feet above high water, and visible 15 miles. The lighthouse is octagonal in shape and erected on the sand hills eastward of the harbor. (See Light List.)

Range lights.—A pair of provisional range lights have been established on the east pier and a pair on the west pier. The alignment of those upon the east pier (64° 40′) passes 5 yards northward and that of those on the west pier (130° 45′) 5 yards eastward of the remains of the west pierhead, destroyed by a gale. (See Light List.)

Basin light.—A fixed green light is exhibited on the east side of entrance to the basin.

Directions.—Strangers entering Nieuport should employ a pilot, on account of the traffic and to secure a berth, unless in case of emergency when, having passed between the pierheads, keep in the fairway, passing close to the poles which are placed in the concaves of the banks on either side, where the deepest water is, until assistance is rendered; or lay the vessel upon the sand on the western side, which may be done with safety.

In consequence of the volume of water which pours out from the sluices at Nieuport, the current which sets out of the harbor is sometimes very strong, especially the first of the ebb.

Tides.—The high-water interval at Nieuport is 0 h. 05 m.; springs range 15¾ feet. (See General Tide Tables.)

Tidal signals.—Night signals are shown from stone pillars erected on the west side of the port, 1,900 yards from the east pierhead; they are made with white, red, and green lights, visible about 5 miles.

Day signals are shown from a mast near the night signals.

Day signal.	Depth on bar.	Night signal.
	Feet.	
A yellow and blue pennant at the masthead	6-8	None.
A yellow and blue pennant at half-mast	8-10	Do.
None	8	White light.
Do	9	White light, with 1 green flash.
A blue penant at the masthead	10	White light, with 2 green flashes.
A blue pennant at half-mast	11	White light, with 3 green flashes.
A blue flag at the masthead	12	White light, with 4 green flashes.
A blue flag at half-mast	13	White light, with 1 red flash.
A white flag with blue cross at the masthead	14	White light, with 2 red flashes.
A white flag with blue cross at half-mast	15	White light, with 3 red flashes.
A red flag at the masthead	16	White light, with 4 red flashes.
A red flag at half-mast	17	None.
A blue pennant at the masthead, white flag under it.	18	Do.
A blue pennant at the masthead, red flag under it.	19	Do.

Pilots.—A pilot cutter, with the name "Nieuport" on the mainsail, cruises off the port and to a distance of 14 miles at times.

Lifeboats—Storm signals.—There are three lifeboats, and storm signals are made from the pilot station close westward of the harbor entrance at Nieuport.

Radio.—There is a radio station at Nieuport; call letters O S T.

Coast—Aspect.—On the low sandy coast between Nieuport and Ostende are several coast guard stations, and the churches of Middelkerke and Mariakerke. The sand dries off from 1 to 400 yards in places.

Raversyde Range Lights were erected to form a range mark through the dredged channel in the Stroom Bank named West Pass, westward of Ostende. The rear light is fixed white, elevated 77 feet above high water, and is shown from a turret. The front light is fixed white with red sector, 57 feet above high water, and is shown from a white iron turret. Both lights are visible 10 miles, and when in line bear 142°. Other channels have been dredged near Ostende and are now in use. The buoys marking the old channel have been removed. (See Light List.)

Ostende Outer Road, situated seaward of the Stroom Bank and in a very slight measure partially protected by the Nieuport, Ostende, and Wenduyne Banks, is 5 miles in length east and west by about 1 mile in breadth, with a depth of 5 to 7 fathoms over a bottom of sand and ooze. It is the anchorage for vessels of moderate draft waiting wind or tide to enter Ostende Harbor. A good position is in about 6 fathoms, with Ostende Lighthouse bearing 143° 30′, distant 2½ miles.

There is good holding ground, in from 6 to 10 fathoms, fine sand and mud, with Ostende bearing about 143° 30′, distant 8 miles. In this latter anchorage the Ostende pilot boats are to be found in bad weather, especially when the wind is from the northward.

Light buoy.—Stroom Bank Light and Whistle Buoy is moored 2.6 miles, 395°, from Ostende Church.

Directions.—The Outer Road is generally entered either from the direction of the Schelde within Wenduyne Bank, or from the northwest between Middlekerke and Ostende Banks. For the latter route the mark is the steeples of Oost Dunkerque and Furnes in line bearing 200° (which leads through the pilot boat anchorage), until Ostende Lighthouse bears 113°, which latter bearing will then lead into the road. The low water depth at the junction of these lines is about 3½ fathoms.

Heavy draft vessels should pass westward of Middlekerke Bank.

At night, after having sighted Ostende Light, which may be seen 20 miles, it will be prudent to stand off and on, or to anchor outside the banks, and wait for daylight, unless locally acquainted or a pilot has been picked up.

Caution.—Easterly gales are comparatively harmless to vessels at anchor in the Outer Road, but it is necessary to guard against those from the northward or westward. With such it will be better for vessels, if they can not enter the harbor, to gain an offing without loss of time, or to run for the Schelde.

Ostende Inner Road, comprised between Stroom Bank and the shore, has but indifferent holding ground, especially in the neighborhood of the harbor, and it should not, therefore, be used except as a stopping place for vessels about to enter the harbor.

Light buoy.—Stroom Bank Light and Bell Buoy is moored 2,400 yards, 301° from Ostende Church.

Directions—Stroom Bank channels—Buoyage.—Three channels or passes have been dredged through the Stroom Bank, connecting the Outer with the Inner Road and harbor of Ostend—namely, the East, the Middle or Direct abreast Ostende, and the West. The latter is about ¼ mile wide, and in the center, on the range mark of the Raversyde Lights in line bearing 144°, the depth is 19 feet at low water springs. A red sector from the front light at Raversyde indicates the central part of the fairway; it is not buoyed and seldom used.

The Direct Pass is from 550 to 800 yards wide, has a depth of 3 fathoms at low water springs, and 5½ fathoms at high water springs on the range mark, namely, Ostende Lighthouse, in line with the light support (green light) on the west pierhead bearing 107°.

The northeast and southwest limits of the Direct Pass are Ostende Lighthouse bearing 114° and 102°, respectively; the least depth on these limits being 2½ fathoms at low water springs.

The East Pass is 900 yards wide, and has a least depth of 2¾ fathoms at low water springs, and 5¼ fathoms at high water springs, on the range mark—namely, the railroad station tower, in line with Ostende Lighthouse, bearing 111°, until within about 1,000 yards from the nearest shore, when a course leads through the center of the pass in 2¾ to 3¼ fathoms at low water.

Unbuoyed at present.

Ostende Harbor, which is an artificial work, skirts the east side of the town. Its outlet is defended on both sides by open wooden piers, about 700 yards in length, the channel being about 200 yards wide at the pierheads, but narrower within in places. It forms the sea terminus to the numerous canals which stretch from hence into the interior of the country; the canal from Ostende to Bruges, etc., admits vessels of about 7 feet draft. (See canal from the sea to Bruges, for large vessels.)

There is every accommodation for discharging and loading into railway trucks alongside the quays.

Depth at the entrance.—There is a depth of 16 feet at low water, ordinary springs, in the entrance to the port, 15 and 16 feet as far up as the Leopold Lock at the entrance of the Outer Flushing Basin, and from 19 to 13 feet up to and in the outer or Avant port. With a spring rise of 15 feet this would give a least depth at ordinary high water springs of 28 to 29 feet to the dock gates.

The depth on the lock sill of the Commercial Dock is shown by the tidal signals; that on the sill of Mey Lock at the entrance to the new basin is 10 feet more. The depth is much influenced by the prevailing winds, being less after a succession of northeasterly winds.

Ostende Light.—The light tower at Ostende, 171 feet in height, stands on a sand hill on the eastern side of the entrance to the harbor. From it is exhibited, at an elevation of 189 feet above high water a fixed and flashing white light. The flash is visible 20 miles; the fixed light is visible 12 miles, consequently at distances exceeding 12 miles the light will appear as a flashing light only. (See Light List.)

East and west pier lights.—A fixed green light, upon the western pierhead, is shown, at an elevation of 25 feet, visible 7 miles, and a fixed red light, on the eastern pierhead, at an elevation of 25 feet, visible 7 miles.

Another light, fixed white, is exhibited at the east pierhead, from a small standard.

Fog signals.—During thick or foggy weather a bell is sounded in the battery on the east pier. An explosive signal is given when the Dover mail boat is approaching the port.

Storm signals are shown from the East Pier Lighthouse.

Outer Flushing Basin Lights.—Two fixed lights placed vertically, white over red, are located near the Leopold Lock. The red light is elevated 34 feet and is visible 5 miles; the white light, 42 feet, and visible 7 miles.

Pilots for Ostende are obtained from one or other of the pilot vessels which cruise about. These vessels are yawl-rigged, they carry a blue flag, with the number of the boat in white on it at the masthead, and have the name "Ostende" surmounted by the letter "P" on the mainsail.

One vessel is stationed to the westward and cruises between Middelkerke and Ostende not farther than 10 miles offshore; another between Ostende and Wenduyne, not farther than 8 miles offshore. In stormy weather they are outside the banks, in Ostende Outer Road.

The Antwerp pilot vessels supply pilots to conduct vessels between the banks until within the range of the Ostende boats, for which service there is a fixed charge.

Directions.—It is slack water at about half flood, which is the best time to enter if there is sufficient water for the vessel, which will be indicated by the tidal signal.

At high water the current is running eastward at its maximum strength, about 2 knots at springs, so that vessels entering between half flood and high water should keep toward the western pier to avoid being swept on the eastern one. There is not much current at high water neaps. The lighthouse in line with the battery on eastern pier is a good line of approach. Sailing vessels should keep westward of the harbor until about to enter to have the benefit of a favorable current. They are, however, recommended to employ a tug.

When a vessel approaches the entrance of the harbor without a pilot on board, or the state of the sea will not allow one to go out, a pilot will place himself on the eastern jetty and show by means of a flag the direction that the vessel must follow.

It is not advisable to enter the harbor during strong winds from northwestward, through north, to northeastward.

Night towage regulations.—Application should be made at the pilot office between 9 a. m. and noon, or from 2 p. m. to 6 p. m., by owners or masters of vessels desiring to be towed out of the port.

At night the requisition should be made to the chief pilot at the docks or at the entrance to the port, or to the master of the tug, which is kept with steam up in the fairway near the entrance to the fishermen's creek.

The night signal for a tug, by vessels approaching the port, is a blue light shown three times at short intervals. This signal should be repeated until answered from the dike by one of the following signals:

(*a*) A red light indictes the signal has been seen and the tug will be informed.

(*b*) Two red lights indicate there is no tug available.

The departure of the tug from the port will be indicated by three blasts of the whistle, the first prolonged, the two others short. When this signal is heard the approaching vessel must show a white lantern light or a flare-up light at short intervals.

To avoid accidents the tug will only take a vessel or fishing boat outside the port in tow if such vessel is at anchor, or hove-to, and showing the proper lights—viz, a white light if at anchor, or green and red side lights if hove-to.

Tides and tidal currents.—The high water interval at Ostende is 0 h. 07 m.; springs rise 16 feet. Strong north-northwest winds have the effect of raising the level considerably, while those from the eastward decrease it.

The flood or east-going current outside the harbor runs from about three hours before until about three hours after high water; then, after a slack, the ebb or west-going current runs until two hours after low water. Its velocity at high water springs is quite 2 knots.

Lifeboats.—There are three lifeboats stationed at Ostende, one on each side of the harbor entrance, and one in the harbor.

Basins.—There are five basins at Ostende. New Basin, with an area of 14 acres, is 2,132 feet in length, 295 feet in breadth, 59 feet wide in the entrance, with 28 feet of water in it. The lock, named "Mey Lock," is 394 feet in length, 59 feet in breadth, with 15 feet on sill at low water, or about 30 feet water at high water, springs. Vessels can be locked at any time according to their draft. Until the lock and basin are lighted, vessels can only be locked during the day. (See Appendix.)

Basin d'Evolution, 11 acres in extent, is 722 feet in length, 656 feet in width, 59 feet wide in the entrance, with 28 feet of water in it, and 30 feet of water on the sill at high water springs, and is entered from New Basin through the Basin Canal. It is connected with the Ostende and Bruges Canal on the one side and with the Commercial Dock on the other.

Basin Canal, 1,132 feet long and 210 feet wide, of 5½ acres area, and the Basin d'Evolution form one dock, which is used for the timber trade, and has special facilities for the discharge of that material.

The above docks will be provided with railways, sheds, cranes, etc.

The Commercial Dock consists of three basins; the outer, No. 1 Basin, is 918 feet in length, 197 feet in width, 39 feet at the entrance, and with a depth of 19 feet in it and 20 feet on its sill at high water springs.

The entrance lock is 205 feet in length, 39 feet in breadth, with a depth of 5 feet on sill at low water springs, equivalent to 20 feet at high water springs.

No. 2 Basin is 557 feet in length, 328 feet in width, 45¾ feet wide at entrance, and has a depth of 18 feet.

No. 3 Basin is 459 feet in length, 312 feet in breadth, 37¾ feet wide in the entrance, and has a depth of 17 feet. These two basins are entered from No. 1. The two latter are to be replaced by new and larger basins, and a new basin, to be named "Bassin de la Marine," is to be constructed just within the outer flushing basin, with a depth of 21½ feet on sill and 23 feet in the dock. Dry docks are proposed.

Tidal harbors.—There are two tidal harbors, one with 1,148 feet of quayage for merchant vessels and 574 feet for Government vessels; the other, for fishing craft, has 2,033 feet of quayage.

Repairs and refitting in all branches of shipbuilding can be effected. There is a crane, capable of lifting 25 tons, and movable cranes at the sides of the docks.

Supplies.—Fresh provisions can be obtained; the drinking water is not good.

Ostende, being an important position, the fortifications, with the promenade in front, named the Digue, command attention from the roads. Ostende has a large Kursaal and other fine buildings, and is much frequented for pleasure and sea bathing; it is connected by railroad with France and Germany, and steamers constantly ply between it and England. The mail packets run daily to and from Dover.

The telegraph office is always open during summer and closes at midnight during the rest of the year.

Coal in very limited quantity is available for steamers.

Tugs may be called by hoisting two flags one above the other.

The coast—Aspect.—The coast, in continuation eastward from Ostende, forms the southwest boundary of the outlet of the Schelde. It has an easterly direction, and presents the same features as that already described, being low and sandy, but with few objects to assist in identifying it from the offing. At 3 miles eastward of Ostende are some sand hills named "Spaniard Duin," which are more elevated than the others, with two pairs of fixed white beacon lights to the westward for leading eastward of the Stroom Bank to the East Pass leading to Ostende, and there is another sand hill noticeable between it and Wenduyne, and also two coast guard stations. Wenduyne Church has a white tower.

Blankenberghe is situated on the shore at about 9 miles eastward of Ostende. Objects of recognition are the church, with its short spire or peaked roof, the two towers of the casino, the cupola on the promenade pier, and, in the distance, the three lofty towers of Bruges. In the summer season there are numerous bathing machines on the beach. It is connected by rail with Bruges and Heyst, also by light railway with Ostende and Nieuport. A canal with a depth of 6 feet joins the Ostende-Bruges Canal.

The port is a little westward of the town, and is only available for small craft. It is entered between two pile jetties, between which and on the bar there is only a depth of about 1 foot at low-water springs and 14 feet at high-water springs.

Lifeboat—Storm signals.—There are two lifeboats at the port and one at the customhouse at Le Coq, or Den Haen, to the westward, and storm signals are shown from a mast on the dyke.

Comte Jean Jetty Lights.—From a red octagonal stone light tower on Comte Jean Jetty, on the east side of the port an occulting white light, visible 14 miles, is exhibited, at an elevation of 83 feet above high water.

West Mole Light.—From an iron stand on the head of the western pier a fixed green light, visible 7 miles, is exhibited, at an elevation of 27 feet. (See Light List.)

Promenade Pier Light.—At the head of the promenade pier, 1 mile eastward of the port is exhibited, at an elevation of 26 feet above high water, a fixed red light, visible about 7 miles. (See Light List.)

Tidal light.—A tidal light is shown from the end of the East Mole at a height of 31 feet.

Fog signal.—A bell operated by electricity is located on the outer end of the eastern pile jetty.

Basin.—The wet dock at Blankenberghe is 787 feet in length, 328 feet in width, with a depth of 14 feet on sill at high-water springs. (See Appendix.)

Coast—Aspect.—Between Blankenberghe and Heyst are visible from seaward the high towers of Uitkerke, the smaller one of Ramskapelle, the blunt tower of Lisseweghe, and the three towers of Bruges, before mentioned. At Heyst, the church spire, the buildings on the dyke, and the breakwater at Zeebrugge outside the canal entrance to Bruges are noticeable. The towns of Zeebrugge and Heyst extend almost continuously as far east as the guardhouse. Within Knocke will be seen the tower of the church at Westkapelle, and near Knocke the flat-topped sand hill named the Gaanpad. Thence to the Netherlands frontier, 3 miles eastward of Knocke, there is nothing conspicuous.

Tidal currents.—Along the Belgian coast the tidal currents run parallel with the shore; off Blankenberghe the east current running from 1¼ hours before to 4¾ hours after high water at Dover; and the west current from 5 hours after high water at Dover until 1½ hours before the following high water there. The average velocity of the east current is 1¼ knots and that of the west current 1 knot.

Zeebrugge—Breakwater (lat. 51° 21′ N., long. 3° 12′ E.).—The breakwater protecting the canal commences at ¼ mile westward of the entrance; it is about 1.3 miles in length and 240 feet wide, convex to the westward, with its eastern extremity 1,350 yards northeastward of the entrance. It has quayage accommodation on the inner side of 5,150 feet, with depths varying from 26 to 32 feet alongside at low-water springs. At 250 yards from the coast the stonework is interrupted and its place taken by pilework for a distance of 328 yards to admit of a current passing through. The breakwater shelters a roadstead of 300 acres in extent from gales between north and west. Numerous lines of railway are laid on the quay, where are several cranes, steam and electric; also good sheds and customhouse. The railway trains run down alongside the vessels and connect at Bruges with the Belgian and continental systems.

In the roadstead is a buoyed channel leading to the canal entrance, marked by black can buoys on the west side and red conical on the east. Its outer end is marked by a red and black horizontally striped buoy B. S. surmounted by a cross.

The roadstead is to be connected with the Wielingen Channel by a dredged channel 29 feet in depth at low water.

Zeebrugge Harbor lights.—A fixed white light, with a red sector elevated 72 feet above high water and visible 10 miles, is exhibited from a round gray masonry tower erected on the outer end of the breakwater at Zeebrugge.

Range lights.—The channel dredged through Zand Bank to the port of Zeebrugge is marked by the following range lights:

Front light.—A fixed light established 41 feet above high water on a white tower erected on the sea dyke. (For sectors see Light List.)

Rear light.—A fixed white light, visible 6 miles, established 94 feet above high water on a white tower located 328 yards 137° from the front light.

Fixed lights, elevated 23 feet above high water and visible 7 miles, are shown from gray towers erected on the canal pierheads; green from the west pier and red from the east pier.

Fog signal.—An electric fog bell is sounded at the outer end of the breakwater.

Pilots for Zeebrugge are obtained from a cutter which cruises between the meridian of that port and 4 miles westward of the Wandelaar Light Vessel (temporarily withdrawn in 1917). The vessel is painted white and carries a white flag with the letter "Z" in black on it at the masthead, and on the mainsail the name "Zeebrugge" in black, surmounted by the letter "P." Pilotage is compulsory for merchant vessels.

Storm signals.—A storm signal station is established at the pilot station, situated on the shore near the inner end of the breakwater.

Signals.—There is a Lloyd's signal station at Zeebrugge.

Tidal signals.—Tidal signals, indicating the height of the water above the level of mean low water springs, are made, by day only, from Lloyd's signal station, as shown below:

Signals.	Height of tide.
Red pennant above flag A	Zero (low water).
Red pennant above flag B	1 foot.
Red pennant above flag C	2 feet.
Red pennant above flag D	3 feet.

And so, alphabetically, to O, 14 feet.

Locking signals.—The following signals for the guidance of vessels wishing to enter the maritime lock are exhibited from the water tower:

By day.	By night.	Signification.
One black ball	A green light over a red light	Prepare to enter lock.
Two black balls	One green light	Enter lock.

The sill of the dock is 18 feet below low water.

Bruges Canal.—The entrance of the Bruges Canal is situated at Zeebrugge, about 2 miles westward of Heyst. The canal is 6.3 sea miles in length, 229 feet in width at the water level, with a depth of 26 feet throughout over a breadth of 72 feet. There is a bridge over it opened when required for the traffic. There are no passing places in the canal for large vessels, but small vessels can pass one another.

The approach from the roadstead of Zeebrugge to the sea lock of the canal is 565 feet wide at the seaward end, is tidal, ½ mile long, with a depth of 18 feet at low water springs and 32 feet at high water neaps, and has a tidal basin for the use of fishing boats on its eastern side. The length of the passage in which the lock of the canal it situated is 625 feet. The lock itself is 518 feet in length and 65½ feet in width, with a depth of 18 feet on the sill at low water and 34½ feet at high water.

Above the lock is the inner harbor, 720 yards in length, 164 feet wide at the bottom, 26 feet deep, and 413 feet wide at the water level. On the east side is a bight which recedes 240 yards, where vessels may turn and where a quarantine station is situated. Dry docks are proposed here.

On the west side are basins or sidings, one of which, 548 yards long and 142 yards broad, is ready.

There are eight electric cranes and a floating pair of sheers capable of lifting 55 tons. The depth in the basin is 26 feet.

Bruges—Basins.—At Bruges the canal from Zeebrugge connects with a large basin, the several parts of which are named the north, east, and west docks, respectively. The north and east docks, and the northern part of the west dock, have a depth of 26 feet; the remainder of the west dock has 21 feet. The total quayage is 2,198 yards, of which 1,481 yards are appropriated for providing twelve berths for vessels. The quays have depths of 20 to 26 feet alongside, and are well equipped with railroad lines, sheds, and cranes, both steam and electric; the largest of the latter can lift 25 tons, and is situated on the south side of the north dock. These basins are connected with the inland canals by a lock 564 feet long and 39 feet wide.

Heyst, a fishing village, situated about 4 miles eastward of Blankenberghe, is of no importance, but has extended considerably along the shore. The church spire is conspicuous.

Heyst Light, fixed green, 37 feet high, visible 5 miles, is exhibited from a position ¾ mile eastward of the church, for the guidance of the fishermen. (See Light List.)

Storm signals are shown from the light post when necessary.

Lifeboat.—Two lifeboats are stationed at Heyst, one on each side of Leopold Canal sluices.

Knocke Village is situated about 2 miles eastward of Heyst and 1 mile inland, with the Gaanpad sand hills in front of it. Its church has a white tower with a stunted spire.

Knocke Light.—On a sand hill close to the shore northward of Knocke, a flashing and group flashing white light is exhibited, at an elevation of 87 feet above high water, from the tower on the keeper's dwelling. It is visible 15 miles. (See Light List.)

Storm signals are shown from the lighthouse, and there is a lifeboat and guardhouse near.

Coast of Holland—Frontier.—The boundary line between Belgium and the Netherlands on the shore of the North Sea is at Sluis Gat, western side of Kadzand; but the town of Sluis on the western side of the gat is in the Netherlands. Kadzand is low and like the rest of the coast at the Schelde entrance. Groede Church lies near its center and the lights of Nieuwe Sluis on its north extremity.

Harbors of Holland.—Vessels of war are not allowed to enter the harbors of Hellevoetsluis, Hook of Holland, Ymuiden, or Nieuwediep, or any of the inner waters, without permission, and their stay in any harbor of the Netherlands is not to exceed 14 days.

The Schelde—General remarks.—The Schelde, or Scheldt, one of the most important rivers of the Netherlands, takes its rise in the French Department of L'Aisne, traverses a part of France, east and west Flanders, and, flowing by Ghent, receives the navigable waters of the Lys and two canals; it then turns easterly to the Province of Antwerp, and then northerly between that Province and east Flanders. At Antwerp the Schelde is ¼ mile wide, and in places has upward of 7 fathoms of water. Abreast the lower part of the city it forms a secure harbor, and there are a large number of wet and dry docks for the accommodation of large vessels.

About 15 miles lower down, the river divides into the East and West Schelde; the former runs around the eastern and northern sides of Beveland Islands and south of Schouwen Island to the sea. The latter branch, which is the main stream, flows westerly between the mainland of Dutch Flanders on the south and Beveland and Walcheren Islands on the north, and joins the sea just below Flushing. The whole course of the Schelde is about 210 miles, and its mouth being directly opposite the Thames, gives to it both naval and commercial importance.

Navigable depths.—The depth of water and direction of the channels of the Schelde are constantly varying, and the buoyage is altered in accordance. The shallow passes in the Schelde are all to be dredged to a minimum depth of 26½ feet and considerable progress has been made in the neighborhood of Bat.

From the latest information the following were the least depths at low water observed in the channels of the West Schelde.

The Wielingen is the southernmost and deepest of the three channels by which Flushing can be reached from the sea; the least depth, 21 feet at low water ordinary springs, is situated between Wandelaar Light Vessel and the red and black horizontally striped buoy, 1 mile eastward of it, and also midway between that buoy and No. 1 black can buoy. Southward of Wandelaar Light Vessel the depth is 4¾ fathoms, but rather less water should be reckoned on on account of the patches and uneven ground here, as well as the force and direction of the wind which affect the depths in all these channels. Springs rise from 13 to 15 feet.

Deurloo, the middle channel, has some patches of 15 to 16 feet on its bar, but the buoyed channel has not less than 20 feet; springs rise about 11 feet.

East Gat, the northern channel, has about 24 feet least water on its bar abreast Kaloo Bank, and is deeper within until near Flushing, where there is a depth of 23 feet in the Sardijngeul. Springs rise about 11 feet.

Flushing.—There is a depth of 21 feet in the outer or railway harbor at Flushing at low water springs, and the same alongside the pontoon, subject to wind influences, but the chart shows only 20 feet in the entrance and 15 feet on the eastern side 250 yards within. There is more water in the approach from sea and in Flushing roadstead. Vessels of 23 feet draft and under can pass through the locks and harbor and navigate the canal through Walcheren, via Middelburg.

Antwerp.—The least depth in the channel at low water between Flushing and Antwerp is 19 feet between the Saeftinge Bank beacons and Doel Bank, some 13 miles below Antwerp. This gives a depth of about 31 feet at high water neaps and 35½ feet at high water springs, subject to frequent change. Vessels must be early on tide for entering the docks.

Vessels of 28 feet draft by day and 26 feet by night can navigate the channel from sea to Antwerp at high water neaps; vessels of 16 feet draft can always reach Antwerp; those drawing 21 feet can do so from four hours before to four hours after high water, and those drawing 24 feet from three hours before to three hours after high water, when in charge of a pilot.

The pilots are prepared to take any vessel of any draft, beam, or length up to Antwerp.

Large vessels bound up the Schelde leave Flushing from one to three hours after low water at that port, and arrive at the Antwerp quays about two or three hours before high water there.

The distance of Antwerp from Flushing by the river is 50 miles.

Vessels of 15 feet draft reach Termonde, 44 miles above Antwerp.

Ice somewhat obstructs navigation of the Schelde in severe winters.

Arrival signals.—The arrival of vessels in the Schelde bound to Antwerp is signaled from Flushing to the pilot and harbor office at Antwerp.

Pilots.—Vessels are stationed at the mouth of the Schelde to supply Belgian pilots to ships bound to Antwerp, or to Ghent, via Terneuse Canal. These vessels bear the following distinguishing marks: The name "Antwerpen," surmounted by the letter "P," painted in black letters on both sides of the sail, as also the number of the boat; at the masthead a red flag, on which is the number of the boat in white figures, and on the stern of the boat the words "Bateau Pilote," and the number. Each pilot is invested with a medal showing his station, grade, and number, and is also furnished with instructions for the guidance of masters of vessels, printed in the English, French, Dutch, Danish, German, Spanish, and Italian languages. These pilots, however, may only conduct the ship as far as Flushing, where a river pilot must be taken if the vessel is proceeding farther. Vessels entering Netherlands ports with Belgian pilots are to pay the Netherlands pilot dues.

The Netherlands pilot vessels for the mouth of the Schelde are schooners and yawls, painted black, and fly a blue flag with the Netherlands flag in the corner, at the gaff, as a distinguishing flag. The name "Vlissingen" and the number of the vessel are painted in black on the mainsail; and a blue flag is carried at the masthead, on which is painted in white the number of the vessel. By night they hoist a white light, and show a flare above the bulwark every 15 minutes.

Should all the pilots from a pilot vessel be employed, the blue flag by day and the flare at night are not shown.

A temporary vessel flies the same signal by day, and, if a steamer, at night she shows three flashes of light at intervals of not more than 15 minutes in addition to her usual lights.

One pilot vessel is always to be found within 8 miles of Dungeness; another as far to the westward of Dungeness as circumstances may require, and others off the Wielingen and Deurloo Channels and northward of Schouwen Island.

The signals for obtaining a pilot from the English Channel or elsewhere to the Schelde are made by the International Code signals.

At Flushing there is a station for both sea and coast pilots of the Netherlands and Belgium. When a pilot is not obtainable a signal is exhibited at West Bastion Lighthouse. The coast pilots take vessels from Flushing to Antwerp, etc., up river.

The sea pilots take charge of vessels at sea and pilot them into the docks at Flushing, etc., and vice versa.

Directions for approaching the Schelde.—Vessels from Dover Strait bound to the Schelde generally steer such a course from the back of the Goodwin as to pass between the West Hinder Bank and the northeastern end of East Dyck or Clif d' Islande Bank, avoiding the obstructions, which gives them a clear and straight course to Wielingen Channel, the best and deepest channel, into the Schelde.

In clear weather Ostend will be sighted soon after passing the West Hinder; then Blakenberghe and the Wandelaar Light Vessel will successively appear.

The depths decrease regularly from the West Hinder to 10 fathoms, a distance of about 10 miles. Nearer the Schelde, patches of 5½ and 6 fathoms are found. The bottom, which is mostly sand, mud, and broken shells, is harder on the less depths; near the Wandelaar the bottom is sand and broken shells.

Working up, the lead should be carefully attended to, and when eastward of the meridian of Ostend the shore should not be approached into less than 4 fathoms at low water, as the Wenduyne Bank is fairly steep-to.

At night.—In clear weather there is no difficulty in approaching Wielingen Channel from the northwestward, as the Wandelaar Light comes in sight before the West Hinder is lost sight of, and Ostend lights are in sight all the time.

Coming from the northward, and having passed Thornton Ridge, Bruges Towers well open westward of Blankenberghe, 137°, will lead to Wandelaar Light Vessel. Bruges Towers in line with Blankenberghe Lighthouse, 146°, lead across Wandelaar Bank, eastward of the buoy and light vessel in not less than 25 feet, and a short distance eastward of a patch of 16 feet.

Or, vessels can pass eastward of the light vessel, and of No. 1 buoy between Wandelaar Bank and the Ribzand, in not less than 29 feet with Uitkerke in line with the cupola on the promenade pier eastward of Blankenberghe, 168°.

Bruges Towers in line with Heyst leads in from the northward, in not less than 20 feet, between the Raan and the Schooneveld Shoals.

From the southwestward, off Cape Gris-Nez, having clear weather and daylight, steer to pass between the Sandettie and the Ruytingen Banks, well northward of the buoys marking the latter and to the fairway southward of West Hinder Light Vessel; thence on the parallel of 51° 22′ N. to the fairway southward of Wandelaar Light Vessel, distant 21.3 miles from the West Hinder.

If from near Cape Gris-Nez and intending to proceed outside the banks, steer to pass about 3 miles northward of the shallow part of the Sandettie and to latitude 51° 22′ N. Keep on that parallel which is to the northward of all the banks and passing over 7 or 9 fathoms upon the southwest tails of Fairy and West Hinder Banks to abreast West Hinder Light Vessel, when proceed as before.

Approaching the Schelde from Ostend, either the Direct or East Pass leading from that port, with depths of 3 and 2¾ fathoms, respectively, at low water springs, must be used. Course is then shaped between Wenduyne Bank and the shore, through Blankenberghe Road to the Wielingen, with a not less depth than 18 feet. It is unbuoyed, and therefore only available with local knowledge.

Schooneveld anchorage (lat. 51° 29′ N., long. 3° 08′ E.), in the offing, northeastward of Wandelaar Light Vessel, affords temporary anchorage with good holding ground, in depths of from 6 to 9 fathoms.

Tugs.—In the Schelde Belgian tugs will be found to tow vessels up to Antwerp, and in fine weather, with easterly winds, they cruise as far out as the Hinder Light Vessels. They have a fixed tariff, according to tonnage.

Tides and tidal currents at Schelde Entrance.—The high water interval at Flushing is 0 h. 57 m.; at the Wandelaar Light Vessel about three-quarters of an hour earlier, and at Antwerp about 2¾ hours later.

The spring rise at Flushing is 15 feet, and what is termed the "mean" rise and fall 12 feet, but it is much affected by the strength and direction of the wind. Persistent northwest gales increase the rise from 5 to 6 feet, while easterly ones reduce the rise about 4 feet at times. The water rises at the Wandelaar Light Vessel for 5¾ hours and falls for 6¾ hours, and in Flushing Road for 6 and 6½ hours, respectively. The greatest rise at Flushing occurs during the fifth hour and amounts to about 3½ feet; and the greatest fall at the fifth hour, nearly 3 feet. The water at Flushing rises as much in the last 2 hours as it does in the first 4. (See General Tide Tables, U. S. Coast and Geodetic Survey.)

Tidal currents at light vessels:

At Wandelaar Light Vessel.		Tide at Dover.	At Wielingen Light Vessel.	
Direction.	Velocity.		Direction.	Velocity.
	Knots.			*Knots.*
WSW	1 to 1¼	5 hours before high water	W. by S.	1¾ to 2¾
SW. by W	1 to 1½	4 hours before high water	W. by S.	1¼ to 1¾
SSW	¾ to 1	3 hours before high water	W. by S.	¾ to 1
S. by W	¼ to ¾	2 hours before high water	Turning from SW. by S. to SE. by E.	¼ to ¾
S. by E	¼ to ½	1 hour before high water	SE. by E	¼ to ¾
Turning from S. by E. to SE. by E.	½ to 1	High water at Dover	E. by N	1 to 2
ENE	1 to 1¾	1 hour after high water	E. by N	1¼ to 2¼
NE. by E	1 to 2	2 hours after high water	E. by N	1½ to 2¼
NNE	¾ to 1½	3 hours after high water	E. by N	1 to 1¾
N. by E	½ to 1	4 hours after high water	Turning to N. by W	¼ to 1
N. by W	¼ to ½	5 hours after high water	W. by S	¼ to ¾
NW. by W., turning to W. by S.	½ to 1	6 hours after high water	W. by S	¾ to 1¼

The following information may be worth perusal, but it is fairly covered by the diagrams on the chart and more readily understood:

On this part of the coast the tidal currents are very irregular when compared with what has been observed farther north on the Netherlands coast. Here, for instance, they revolve in a direction opposite to the sun, whereas northward of Goeree they follow its course. The different directions which the currents take from hour to hour are nevertheless of much importance to a vessel running in among the banks or making for a harbor.

In order to have a general point of reference for discussing these currents, the time of high water at Flushing will be found the best adapted for the purpose. By reckoning in the usual manner it may be ascertained how many hours have elapsed since the last high water there at the time designated.

Outside the banks, in the open sea, the general flood current runs about northeast by east and the ebb about southwest by west. There, as well as outside the gats, or entrances to the West Schelde, the after flood, as it is called, begins two hours before it is high water at Flushing and runs about east for the Walcheren coast, turning northward until it is high water, when its direction is about northeast. The current continues to bend away from the coast, so that at one hour after high water it will have a north-northeasterly direction; at two hours after high water at Flushing it will run about north; and at the third hour after high water, or at half ebb at Flushing, north-northwest.

The current slacks at about half ebb at Flushing, and the rotation then accelerates. At the fourth hour it sets west, at the fifth hour about west-southwest, and at low water at Flushing it is running about southwest, so that from high water to low water the current has varied in direction 180°.

With the flowing tide the rotation follows the same order, so that at the seventh hour after high water (always at Flushing) the current runs south-southwest; at the eighth, south; at the ninth, south-southeast; at the tenth, east; at the eleventh, east-northeast; and at the twelfth hour, or second high water, northeast again; having thus, during the six hours of the flood, run successively toward the remaining 180° against the sun, so that a vessel at anchor in a calm would, in the course of the ebb and flood tides, have swung to all the points of the compass; but it is proper to remark that the current changes its direction most quickly near the entrance of the gats.

The currents outside the entrances to the West Schelde attain their greatest velocity at high water, and at about low water at Flushing. The maximum observed velocity under ordinary circumstances of the east going current is 2¾ knots and of the west going current 2½ knots. (H. O. Charts 5213 to 5224, inclusive, contain all information about currents for this vicinity.)

Lights—Wielingen Channel—Flushing.—The following lights apply chiefly to the navigation of Wielingen Channel:

Wandelaar Light Vessel (lat. 51° 22′ N., long. 3° 00′ E.) is moored in about 5¼ fathoms, with Blankenberghe Lighthouse bearing 128°, 5¼ miles, and Wielingen Light Vessel bearing 83°, 7 miles. The vessel is painted red with a black streak, and has "Wandelaar" in white letters on both sides; two red balls, placed vertically, are carried at the masthead.

The light is flashing white, shown at an elevation of 34 feet and is visible 11 miles.

The light is lowered 12 feet during bad weather. A riding light is also shown.

If the flashing light can not be exhibited, a fixed white lantern will be shown from the masthead, and a white flare every 10 minutes from above the gunwhale.

When the light vessel is not on station the usual lights will not be exhibited, but three fixed lantern lights (upper white and others red), placed vertically, will be shown. By day a red flag will be hoisted at the masthead. The signals for assistance are the same as for Wielingen Light Vessel.

Fog signal.—In foggy weather a siren is sounded; or a bell in case the siren is out of order. (See Light List.)

Submarine fog bell.—The light vessel is fitted with a submarine fog bell.

Wielingen Light Vessel.—The light vessel, for leading through Wielingen Channel, is moored in 6¼ fathoms, with Heyst Mill bearing 140°, distant 3.8 miles, and Blankenberghe Church 207°; this position is about ¼ mile southward of the line of the Nieuwe Sluis Lighthouses in one, the front light being distant 12 miles.

The light is occulting, showing red and white alternately. It is exhibited at an elevation of 39 feet above the sea, and should be visible 9 miles. A riding light is also shown.

The vessel is painted in red and black horizontal streaks, with "Wielingen" in white letters on the sides, has a jigger mast and carries a red ball at the masthead.

When, from any cause, the flashing light can not be exhibited, a fixed red lantern light will be shown from the masthead, and a white flare every 10 minutes from above the gunwale. When the light vessel is not in station, the usual lights will not be exhibited, but three fixed lantern lights (the upper red and the others white), placed vertically, will be shown. Should the light vessel be in need of assistance, in addition to the above-mentioned lights a fixed white light will be shown from the stern, and a red rocket will be fired every 15 minutes; by day, the signal flags N C will be hoisted.

Fog signal.—In thick or foggy weather the siren on board the Wielingen Light Vessel is sounded. If the siren is disabled, a bell will be sounded in a similar manner.

Nieuwe Sluis Lights are 1,163 yards apart, in a 264° direction, erected on the sea dike. The rear and eastern light, flashing white, is elevated 88 feet and is visible 15 miles; it is shown from a yellow octagonal iron tower 73 feet in height. (See Light List.)

The front light, fixed white, is 44 feet above high water, and is visible 12 miles. (For arc of visibility, see Light List and chart.) It is shown from a gray lantern, 37 feet high, erected on a yellow iron framework support. A fixed white light of less power is also exhibited in the gallery of this lighthouse at a distance of 6 feet below the above light, to render the light more powerful in the Wielingen Channel, where they will probably appear as one.

The lights in line lead through Wielingen Channel, but close to the buoys on the north side.

Fog signal.—The siren is sounded at Nieuwe Sluis. When the siren can not be sounded, a hand fog horn will be used.

Telegraph.—The lighthouses are connected with the telegraph system.

Storm signals.—The night storm signal, a red light, having the same signification as the black ball by day, is shown near Nieuwe Sluis (front) Lighthouse, and on the west side of entrance to the Outer Harbor, Flushing.

Kruishoofd Light.—A fixed red and white light is shown at an elevation of 26 feet, from a dwelling with blue roof, on the embankment, 1½ miles westward of Nieuwe Sluis (western) Light; the red light can be seen 4 miles, the white light 5 miles.

Coming from the westward, when the light changes from red to white, the vessel will be eastward of Sluische Hompels, and course must be altered from the line of Nieuwe Sluis Lights to pass about ½ mile northward of those lights.

Flushing.—West Haven Bastion Light, on the west side of entrance to the commercial port, is occulting, elevated 49 feet above high water, and shows white, red, and green sectors. Should the apparatus fail, the light will be shown fixed. The light support is an iron pentagonal framework, 31 feet high, with a reddish-brown house.

Pilot signal.—When a pilot can not be obtained, a red light will be shown under West Haven Bastion Light; by day a red pennant.

Jetty Light.—A fixed white light, visible 3 miles, is exhibited from the end of the jetty forming the west side of entrance to the commercial port.

Range Light.—A light is shown from an iron post, painted brown, situated 291°, distant 400 yards from West Haven Bastion Light. It is a fixed light showing red and white sectors, elevated 31 feet above high water. This light in line with West Haven Bastion Light forms a range for the Galgeput and Sardijngeul Channel. (See Light List.)

West Jetty Light.—On the west jetty head of the outer harbor a fixed light is exhibited, showing red over the roadstead and green over the harbor.

East Jetty Light.—From the east jetty head a fixed light is shown, visible 4 miles, which shows green over the roadstead and red over the harbor. When entering or leaving the harbor the red light will be on the port hand and the green on the starboard. The lights are shown from yellow iron frames.

Railway Port Light, fixed white, 26 feet above high water, visible 10 miles, is shown from a yellow house on black hexagonal frame, 24 feet high, situated on the east side of the outer harbor.

Fog signal.—A fog signal is established at the west jetty. The signal is a horn, worked by steam and compressed air.

A submarine bell, worked by hand, has been placed at the west jetty head of the outer harbor for the use of the steamers running from Queenborough to Flushing.

Fort de Nolle Light is fixed, with white, red, and green sectors, elevated 39 feet, from a gray iron structure on the west point of Nolledijk.

Harbor signal lights.—When the harbor is inaccessible by day a red flag is shown on the west jetty head; and by night a second red light is exhibited near the regular light. The exhibition by day of a red and a green flag, and by night a green light near the two red lights, denote that vessels not exceeding 19½ feet draft may enter the harbor.

Lights—East Gat.—The following lights apply chiefly to the navigation of East or Oost Gat:

Domburg Light, on the northwest coast of Walcheren Island, is fixed, showing white and red sectors. It is exhibited from the keeper's dwelling on a sand hill near Domburg, at 47 feet above high water, and the change of color from white to red marks the termination of the line of the range lights on entering East Gat. The white light is visible 12 miles, and the red 6 miles.

Westkapelle Light, the main range light for the East Gat, is flashing white, elevated 172 feet above high water, and visible 19 miles, except where obscured by the land. It is shown from a red square stone tower, 163 feet high, near the village on the western point of Walcheren.

Westkapelsche Dyke Light.—From a red circular iron tower, situated at Westkapelsche Dyke, 1,550 yards 329° from Westkapelle Lighthouse, is exhibited, at a height of 59 feet above high water a fixed light, showing white and red sectors. The white and red lights are visible 13 and 7 miles, respectively. This light in line with Westkapelle Light, 149°, leads between the Steen Banks to the East Gat.

Telegraph—Signals.—Near Westkapelsche Dyke Lighthouse is a signal and telegraph station connected with the system of the Kingdom.

Storm signals.—The night storm signal, a red light, having the same signification as the black ball by day, is shown from a signal mast near the Westkapelsche Dyke Lighthouse, in addition to the day signals.

Zuiderhoofd Light, on the mole head westward of the main Westkapelle Light, is fixed, with white red, and green sectors. The light is elevated 29 feet above high water and is shown from a pole on a yellow house on brown posts. (See Light List.)

Zoutelande Light, nearly 2 miles southeastward of Westkapelle, is fixed white, exhibited from a black iron framework structure, 21 feet high, on the sand hills, and is elevated 46 feet above high water. Westkapelle and Zoutelande Lights in line 326° lead through a portion of East Gat. (See Light List.)

Telegraph.—Zoutelande is a telegraph station.

Kaapduinen Leading Lights are exhibited on the sand hills 2 miles, 144°, from Zoutelande; the rear light is group occulting white, elevated 91 feet above high water. It is shown from a square lighthouse of iron, standing upon an open iron framework support, the whole being 10 feet high and painted red.

The front light is fixed white, elevated 48 feet above high water, and is shown from a structure similar to the above, but 18 feet high, erected at a distance of 200 yards 309° from the rear light.

The above lights are only visible from the northwestward, and when in line, 129° lead through East Gat. (See Light List.)

Flushing approach—Sand banks.—The Fairy, Hinder, and Bligh Banks, and Thornton Ridge, lying in the offing of the Schelde, and obstructing the approach to it, have been described. There are also, within or northeast of Thornton Ridge, banks of a similar character, such as the Middel and Steen Banks; but as these latter are opposite the Roompot to the northward of Walcheren Island, they will be noticed under the head of East Schelde.

Binnen Paardenmarkt is a narrow bank, some 6 miles in length, lying parallel to and about 1 mile distant from the shore, between Heyst and Zwarte Polder. A patch near its eastern end dries at low water, and on the remainder are depths of 1 to 2 fathoms. It, with a bank of 17 feet from 1 to 2½ miles to the westward and 1 mile off Heyst, and Wenduyne Bank, forms the southern boundary of Wielingen Channel.

Appelzak is a narrow channel between Paardenmarkt Bank and the shore with depths of from 5 to 6 fathoms. Its eastern entrance has about 3½ fathoms and would be only available by small craft with local knowledge.

Wandelaar Bank lies northwestward of Blankenberghe, from 4 to 5½ miles. Its general depths are from 4 to 4½ fathoms, over an irregular bottom of broken shells, with one patch of 21 feet, situated with Blankenberghe Lighthouse 144°, distant about 5.3 miles, and another of 21 feet 1½ miles eastward of it.

Bol van Heyst, Knocke, and Sluische Hompels Banks form the northern boundary of Wielingen Channel and the southern of the Spleet.

The Bol van Heyst is situated on the eastern part of the Ribzand, which has from 4 to 5 fathoms and extends eastward from the Wandelaar Bank. It has 14 feet least water; the Knocke has 15 feet, and the Sluische Hompels, which consists of two separate banks, from 4 to 15 feet. Both Knocke and Sluische Hompels Sands are steep-to on their south side. The latter shoal is covered by the red sector of light from Flushing West Haven Bastion.

Buoyage of Wielingen Channel.— The outer buoy of the Wielingen Channel, black and red horizontally striped, and surmounted by a black cross, and marked "Wandelaar" in white letters, lies in 5 fathoms, about 670 yards southward of the 21-foot patch on Wandelaar Bank; the Wandelaar Light Vessel lies about 1.2 miles west-southwestward of the buoy.

Black can buoys, numbered from 1 to 10, mark the north side of Wielingen Channel between the Wandelaar and Flushing; No. 4 has a truncated cone topmark; No. 8 is a light and whistle buoy, painted black, exhibiting a group occulting red light every 20 seconds—thus: light 14 seconds, eclipse 2 seconds, light 2 seconds, eclipse 2 seconds. Nos. 9 and 10 mark the southeast edge of the Walvisch Staart, westward of Flushing.

Two red conical buoys mark the south side of Wielingen Channel between the Wielingen Light Vessel and Nieuwe Sluis. No. 2 is a whistle buoy, painted red, exhibiting an occulting white light every 10 seconds—thus: light 7 seconds, eclipse 3 seconds—and lies near the east end of the Binnen Paardenmarkt. Eastward of Nieuwe Sluis is moored a spherical buoy, painted in black and red horizontal stripes, with staff and diamond marked "Br.," off the northwest end of Plaat van Breskens.

Plaat van Breskens—Light and whistle buoy.—The spherical buoy, marking the northwestern extremity of this shoal, has been replaced by an experimental black and red horizontally striped light and whistle buoy, exhibiting an occulting red light every 10 seconds—thus: light 7 seconds, eclipse 3 seconds.

Banks between the Wielingen and Deurloo.—The Schooneveld, Raan, Walvisch Staart, and Elleborg, at times called collectively the Raan, are four sands lying nearly in the middle of the mouth of the Schelde. They curve in a direction nearly parallel to the Heyst, Knocke, and Sluische Hompels, and form, between the latter and themselves, the Spleet Channel, which is unbuoyed, while together they constitute the southwest side of Doeurloo Channel.

Schooneveld Bank lies on the southwestern portion of the flat, westward of the Raan, known as the Van de Raan. It consists of two patches on which the least depth is about 16 feet, subject to change.

Raan Bank has depths of less than 3 fathoms. On its southwest edge are patches of 6 to 8 feet, but its northern part is fairly even.

Walvisch Staart and the Elleborg may both be considered as a continuation eastward of the Raan, and are very shallow ridges. The south side of the Walvisch and the north and east sides of the Elleborg are steep-to. Both banks dry in their eastern portions.

Nolleplaat is the extension eastward of the Walvisch and the Elleborg. It is very narrow, is steep-to on its north and south sides, and has 3 feet least water. The Sardijngeul, a narrow channel, separates it from Flushing. This shoal is reported to have extended eastward.

Buoyage of Deurloo Channel.—The outer buoy of Deurloo Channel is a nun fairway buoy, painted in red and white horizontal stripes, with staff and diamond as topmark, and marked "Deurloo" in black letters. It lies in 5½ fathoms with Westkapelle Lighthouse 89°, distant 8 miles.

The southwest side of the Deurloo Channel is marked by eight red conical buoys, which lie on the northeast side of the Raan and Elleborg. No. 1 has a ball, and lies north of the northwest extremity of the Raan; No. 6, at the southeast extremity of the Elleborg, also has a ball as topmark.

The northern side of the channel is marked by five black can buoys. No. 1, the outer, is surmounted by a truncated cone and marks the western extremity of the patches outlying the Rassen. It lies about ½ mile northeast of No. 1 red buoy.

Banks in East Gat—Kaloo, Botkil, Rassen, and Zoutelande Banks, which collectively may be termed Rassen,[1] make the next group of shoals, which fronting the western coast of Walcheren in the form of an irregular triangle, separates Deurloo Channel from East Gat, and with the shore of Walcheren bounds the latter passage.

Kaloo and Botkil Banks may be considered as the northeastern portion of the Rassen and the western boundary of the entrance to the East Gat. There is a patch of 13 feet upon the Kaloo, and from 9 to 18 feet is charted on the Botkil, northward of Rassen patches. Vessels may cross the Botkil in about 15 feet at low water with Middleburg Church in line with Westkapelle Lighthouse bearing 105°.

The Rassen is one of the banks which separate the Deurloo Channel from the East Gat; it has very irregular depths, and dries in two places on its eastern side; its southeast side is steep-to. No. 1 can buoy, above mentioned, marks the westernmost of its outlying patches.

Zoutelande Bank is the continuation southeastward of the Rassen. Several patches on it dry at low water and its northeast and east sides are steep-to. The Deurloo and East Gat join at its southeast extremity, from which junction the channel eastward is known as the Galgeput and thence between the Nolleplaat and Flushing as the Sardijngeul. The banks on the western side are very steep-to.

Kueerens, or Domburger Rassen, is the continuation northeastward for about 4 miles of the flat on which the before-mentioned banks lie. There are several patches near its center having from 12 to 18 feet, almost connecting with the shore flat, on either side of which are the East Gat and the Channel of the East Schelde. There is a considerable sea over the bank when the wind is strong and against the tide. The bank is covered by red sectors of light shown from Westkappelsche Dyke and Zuiderhoofd.

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[1] The name Rassen is applied by the Dutch to several smaller shoals upon this coast, and seems to imply some rotary or irregular motion of the tides in the neighborhood, probably equivalent to the English word Race.

Buoyage of East Gat.—The East Gat and its continuation, the Galgeput and Sardijngeul, to Flushing, are marked as follows:

The outer buoy is the Midden Steenbank off the East Schelde. The outer buoy of the East Gat proper is the buoy known as the Kaloo, though the channel is between it and Kaloo Bank. It is a light and whistle buoy, painted in black and red vertical stripes, marked "Oosgat," and exhibits a group flashing white light every 20 seconds—thus: Light 14 seconds, eclipse 2 seconds; light 2 seconds, eclipse 2 seconds. It is moored in 5 fathoms, 1.5 miles eastward of the northeast extremity of Kaloo Bank, with Westkapelle Lighthouse 160° about 4 miles.

Within it the East Gat and Galgeput are marked by two red light buoys, five red nun buoys, and one red and black horizontally striped buoy, with cone, No. 5.

Sardijngeul—Buoyage.—This channel is marked by two red conical buoys on the southern side, marked Nos. 1 and 2; a black can buoy, No. 1, on the northern side and a red and black horizontally striped light buoy, No. 3, exhibiting an occulting white light at the eastern extremity.

Depth.—There is a depth of 26 feet in the Sardijngeul Channel.

No. 1 buoy is a light and whistle buoy, painted red, exhibiting an occulting white light every 10 seconds—thus: Light 7 seconds, eclipse 3 seconds—and marks the east side of the Rassen, abreast Westkapelle. Nos. 2 and 3 are nun buoys and No. 4 is a light buoy showing an occulting white light of the same character as No. 1. These mark the eastern edge of the Zoutlande Bank. No. 5, a middle ground buoy with cone, lies at the southeast extremity of the same bank. Nos. 6, 6a, and 7 nun buoys mark the east edge of the Elleborg and northwest edge of Nolleplaat.

Wielingen Channel and its continuation, Fransche Pass, is by far the best passage into the Schelde. The channel begins at the Wandelaar Light Vessel (temporarily withdrawn in 1917), from whence it is about 22 miles to Flushing. The least depth is near the Wandelaar, where about 26 feet may be reckoned on at low water springs.

Shoal.—A shoal of 25 feet is situated in this channel in a position 1½ miles westward of Nieuwe Sluis.

As this shoal is situated only a short distance southward of the line of Nieuwe Slius Range Lights, vessels of heavy draft should be careful, when in the vicinity, not to get to the southward of the range line.

Tidal currents.—When once in the Wielingen Channel the current will be found to run more in the direction of the channel, east or west, during the strength of the current, than outside, where it runs more northeast and southwest. At the light vessel the current runs eastward from two and one-half hours before until one hour after high water at Flushing, with a average velocity of 1½ knots; thence it turns against the sun, with less velocity, and three hours after high water its direction is north-northwest and four and one-half hours after it is west, in which direction the current, with an average velocity of 1½ knots, runs until five hours before the next high water at Flushing. The current then turns against the sun with decreased velocity, and at four hours before high water sets southwest and at three hours east-southeast. See the tables of tidal currents at the light vessels previously mentioned, where the turn is referred to Dover, which is one and three-fourths hours earler than Flushing. The currents in this vicinity are shown on H. O. Charts 5213 to 5224.

Buoyage.—The buoys marking the Wielingen Channel have been mentioned when describing the banks forming it. The Netherlands Uniform system has been carried out—red conical buoys on the starboard hand and black can buoys on the port hand on entering.

Directions for approaching the Schelde have been previously given. Wandelaar Light Vessel lies in the fairway of the approach to Wielingen Channel, but the usual course is southward of her, in from 26 to 30 feet at low water; from whence an 83° course, allowing for the tidal current, will lead to the Wielingen Light Vessel, also in the fairway, southward of Nos. 2 and 3 black buoys. Continue the above course past and on either side of the light vessel, and when southward of No. 3 black buoy steer between the red buoys on the starboard hand and black buoys on the port hand, with Nieuwe Sluis Lighthouses in line, 85° through Fransche Pass, until between No. 8 black light and whistle buoy and Kruyshoofd Mole, avoiding, if of heavy draft, the shoal of 25 feet; thence for Flushing, southward of the Nolleplaat buoys. The Spykerplaat Ridge, with 23 feet, a good ½ mile southward of Flushing, may be avoided, if necessary, by keeping northward toward the Nolleplaat buoys or southward toward the No. 1 red light buoy of the Spykerplaat Bank.

At night.—From abreast and southward of Wandelaar Light Vessel steer to pass close southward of the Wielingen Light Vessel, and when about 1½ miles to the eastward of the latter the Nieuwe Sluis Lights should be brought in line; these should be steered for until Kruyshoofd Light changes from red to white, whence course should be altered to about 59° for Flushing, keeping in the white sector of the West Haven Bastion Light.

Turning through.—For working up the Wielingen no marks can be given, but it is not probable that a stranger will be without a pilot. The soundings are tolerably regular, and after passing No. 4 black buoy both sides may generally be approached to the low-water depth of 5 fathoms; caution is necessary when standing toward the Knocke, the Sluische Hompels, and the eastern part of Paardenmarkt Bank, for they are steep-to. Groede Church, midway between Wulpen Clumps, 55°, leads eastward of Sluische Hompels.

The nature of the bottom is a good guide; in the channel it is soft and near the sides it is hard.

Spleet Channel lies northward of the Wielingen. The south side is steep, but the north side may be approached to 3 fathoms until as far advanced as the Walvisch Staart, where the sides are irregular. The Spleet Channel is unbuoyed and is seldom used by vessels. It may, however, with local knowledge, be used by vessels of 16 feet draft.

Deurloo Channel (lat. 51° 30′ N., long. 3° 20′ E.), the middle entrance to the Schelde, is bounded by the Raan and Elleborg to the southwest and by the Rassen and Zoutelande Banks to the northeast.

Of the buoyed entrances to the Schelde the Deurloo may be considered the most difficult, not only because the banks extend so far out, so that it is not always easy to make out the landmarks, but more especially because the depths are so irregular that the lead is but little guide; secondly, on account of the flat which lies across its mouth, named the Drempel or bar, outside which vessels of deep draft always have to wait till half-flood or later before they pass it; and, thirdly, with sailing vessels, because the early tide running southerly, and not directly into the Deurloo till two hours before high water, might, with scant wind, set them on the Raan.

The Drempel, or bar, as well as the bottom in the middle of the channel, is hard; but the margins of both the Raan and Rassen consist of soft clay and the bottom seaward of the bar is also soft. This bar or flat is of considerable breadth and has patches of 15 to 16 feet in places (the least depth in January, 1909, was 15¾ feet); but the bar fairway, between the two outer No. 1 buoys, has not less than 20 feet as charted; there is the same depth between the No. 5 pair of buoys and 26 feet in the Sardijngeul; elsewhere it is deeper.

Tidal currents.—Outside Deurloo Channel the rotary movement of the tides takes place as already described. As above mentioned, the current does not set fairly into the Deurloo until two hours before high water and fairly out until two hours before low water. The flood after half tide sets onto the Elleborg and the first half of the ebb onto Zoutelande and Rassen Banks.

Buoyage.—In addition to the Deurloo outer fairway buoy, red conical buoys mark the starboard hand and black can buoys the port hand on entering, details of which are given with the banks.

Directions.—As a rule, it is not advisable to make the Deurloo by night, and by daytime it should only be attempted when the marks can be clearly distinguished. The lead is no guide to a stranger, but it is scarcely probable that a vessel can not obtain a pilot in the offing. A vessel waiting for tide should keep Oostkapelle in line with or open northward of Domburg, on Walcheren Island, or the towers of Bruges open westward of Heyst. The position given by these two lines is about a mile northward of Deurloo Outer Buoy and a good place to anchor in fine weather.

Approaching from the westward, the following bearings of Westkapelle Lighthouse, when it can be seen, lead clear of the banks:

Bearing 89° leads southward of Thornton Ridge; 102°, between the Thornton and Rabs (nothward of the gas and whistle buoy); bearing 112°, between the Rabs and Steen Banks, subject to change.

If approaching from the southwestward, keep in 7 to 8 fathoms of water upon the outer edge of the Raan while nearing the outer Deurloo Buoy.

Approaching the bar, Middelburg Church spire kept northward of the hollow in which Zoutelande stands leads to the bar; the channel is then between the red and black buoys through Deurloo Channel and through the Galgeput and the Sardijngeul to Flushing. There is nearly as good water (about 20 feet) southward of No. 1 red buoy with Middelburg and Zoutelande Churches in line 92°, until Domburg is in line with the northern range light at Westkapelle, bearing 60°; thence between the inner buoys, as before. The north side of the Elleborg is steep-to.

Turning through should only be attempted by a vessel in charge of a pilot.

East Gat (lat. 51° 34′ N., long. 3° 24′ E.)—**Depths.**—East or Oost Gat, between Kaloo Bank and Botkil Bank on the west side and Kueerens Banks on the east side, is easy to make, as the landmarks are readily made out in clear weather. The Wielingen is, however, the best and deepest, as before stated.

There is a least depth of about 24 feet on the bar of the East Gat abreast Kaloo Bank, with a spring rise of about 11 feet; there is deeper water within.

The southern portion of East Gat, which bears the name of Galgeput, lies between the coast of Walcheren and the east side of the Elleborg. Its continuation eastward to Flushing is a narrow channel named the Sardijngeul, with 26 feet on its bar.

Tidal currents in the East Gat.—In the East Gat, northward of Westkapelle, the tidal currents revolve in every respect the same as they have been stated to do at sea; within, they run more or less in the direction of the fairway. The flood, or rather the entering of the water abreast Westkapelle, begins about five hours after high water at Flushing, setting toward the Rassen and Zoutelande Banks; only when it attains its maximum does it set straight through the fairway and through the Sardijngeul to Flushing. About one hour before high water at Flushing the western current makes through the Sardijngeul toward the East Gat; it then sets toward the shore and afterwards straight through the fairway. These currents are nearly the reverse of those in the Wielingen.

Buoyage.—With the exception of the Oost Gat Light Buoy and one black can buoy on the shore flat near and close westward of Flushing, all the buoys are red or striped and starboard hand buoys on entering.

Directions.—In clear weather Middelburg Church spire and the lighthouses of Westkapelle and West Schouwen are easily distinguished from outside the banks, but in hazy weather, although the lead is a safe guide for the avoidance of the banks, the bottom is so irregular that the position of the vessel is not obtainable from the depths, so that it is necessary to get a departure from the light vessels in the offing, at which time it would not be prudent to attempt to enter without a pilot; neither does it seem advisable at any other time to do so. All the banks are steep-to within Westkapelle.

From the northwestward, approach East Gat with Middelburg and Domburg Churches in line bearing 131° until Westkapelle Lighthouse is in line with the lighthouse on the dyke northward of it, bearing 148° when the vessel will be westward and nearly abreast of Midden Steen Bank Light Buoy. The lighthouses being steered for, in line, will lead in the fairway across the bar, and between Kaloo Bank and Oost Gat Light Buoy. From abreast the buoy, steer for Groede Steeple open of Westkapelle Point, bearing 161°, which will lead up to Westkapelle, between it and No. 1 red light and whistle buoy. The course will now be 129° on the line of the two light towers of Kaapduinen, until on that of the lighthouses of Westkapelle and Zoutelande on a 325° bearing, astern, which line should be kept until the Flushing West Bastion Lighthouse bears 112° in line with the light post northwest of it, which line will lead northward of Nolleplaat red buoys; thence through the Sardijngeul between No. 3 red and black horizontally striped buoy of the Nolleplaat and the black buoy on the shore flat, into Flushing Road.

If coming from the northeastward, pass westward of East Banjaard Buoy, eastward of Noord Steen Bank Buoy and westward of the South Banjaard Buoy, continuing southwestward until Oost Gat Light Buoy bears 164°; then it may be steered for; thence as before. Zuiderhoofd Mill near the point westward of Westkapelle Lighthouse, open westward of Westkapelsche Dyke Light, 182°, leads over South Banjaard Buoy and westward of the shoal southwest extremity of Banjaard Bank, should the buoy be adrift or out of position.

The East Gat is too narrow for vessels of other than very light draft to work in.

At night.—The services of a pilot are advisable. Coming from seaward for the entrance of East Gat, keep Westkapelle (flashing white) Light in line with the fixed white light on Westkapelsche Dyke, bearing 148°, which will lead between the Steen Banks, passing nearly ½ mile westward of the Midden Steen Buoy which shows an occulting white light, and through the fairway of East Gat in 24 feet at low water, subject to change, into the white sector of Domburg Light and between Kaloo Bank and Oost Gat Light Buoy.

When Zuiderhoofd Light, showing white, bears 162°, and just before passing out of the white into the red sector of Domburg Light, steer about 168° to pass about 500 yards off Zuiderhoofd Light and nearly midway between it and No. 1 buoy, which shows an occulting white light. Zuiderhoofd Light shows red when bearing westward of 166°, which sector should be avoided. When Zuiderhoofd Light changes to green, the vessel will be between it and No. 1 red light buoy, and course should be altered for Kaapduinen Lights in line 129°; thence with the Zoutelande Lights in line astern 325° passing No. 4 buoy, showing an occulting white light, on the starboard hand, until the Flushing West Bastion occulting red light and the light northwestward of it, which shows fixed white, are in line 112°. These latter lights lead through the fairway until abreast of No. 2 Nolleplaat Buoy, when steer for light buoy No. 3.

Local knowledge is absolutely necessary for the navigation of this latter portion at night, and a stranger should anchor, before reaching it, in the Galgeput.

Flushing Road affords good anchorage, in from 5 to 8 fathoms, over a bottom of sand and broken shells, about ¾ mile southeast of the town, on the continuation eastward of the Spykerplaat Ridge, the least depth on which is 23 feet. The water is deeper northward and southward of this ridge and the tidal currents are stronger. A wreck with a depth of 33 feet over it lies about ¼ mile southward of the ridge.

Vessels should anchor either to the northeastward of No. 1 Spykerplaat Bank Light Buoy, or to the westward of it, if wishing to avoid Spykerplaat Ridge.

The West Haven Bastion Light shows green over this anchorage.

Under no circumstances should vessels anchor between Spykerplaat Ridge and Flushing Pier, as there they would be in the way of the traffic, as vessels approach the west side of the town to receive or discharge pilots. Gales from the westward send in a heavy sea, which compels vessels to seek shelter higher up the river. Those of light draft may find good and safe riding in Rammekens Road, 2 miles eastward of Flushing, between the northwest side of the Kaloot and the shore.

Large vessels must run up the river and seek shelter off Terneuse; there are no good landmarks, but the buoys, red to starboard and black to port, combined with the lights, are good guides should there be no pilot available.

The church at Flushing has been destroyed by fire.

Tidal currents.—The eastern or flood current attains a mean velocity of 1¾ knots in the road, its maximum occurring one hour before high water; slack occurs at about one hour after high water. The first of the ebb runs northwestward over the Nolleplaat and the Walvisch Staart (a brisk ebb is then already running in the Sardijngeul) and raws to the eastward of the Wielingen Light Vessel over the Raan until the banks have shoaled, when the ebb runs straight from the road to the Wielingen. The ebb runs at an average velocity of 1½ knots, and attains its maximum at four hours after high water at Flushing and ceases at about five and a quarter hours before high water.

Flushing—Aspect.—High sandhills, which appear as distant hummocks from the offing, extend from Westkapelle to the fortified town and arsenal of Flushing (Vlissingen), which, with the outwork at Breskens on the opposite side of the Schelde, completely commands the river. The tall spire of its church, the smaller Roman Catholic Church tower, the large square stadt house, the mills, the water tower, the light structures, the building sheds, and other works pertaining to a naval arsenal, taken in connection with its advanced position upon the south point of Walcheren, render Flushing prominent from every part of the entrance to the Schelde. Population of Flushing in 1911 amounted to about 24,575.

The United States is represented by a consular agent.

Harbors, depths in.—There is an outer and an inner harbor, the latter consisting of two harbors. They are never closed by ice, and vessels that can enter the harbors have no delay when entering by the main or Wielingen Channel from sea.

The outer or railway harbor is 33 acres in extent and has a depth of 21 feet at low water springs. There are floating stages alongside the quays for the convenience of the mail and passenger steamers which frequent the port. It is separated from the inner harbors by two locks, the larger of which is 481½ feet in length and 65½ feet wide, with 26½ feet of water on the sill at ordinary high water.

The inner harbors have a combined area of about 28 acres, with a depth of 21¼ feet below the canal gauge. There are warehouses, railways, and cranes around the quays. The Walcheren Canal is entered from the western one.

In the eastern one vessels of war are laid up in ordinary.

The western entrance to the inner harbors is through the marine port, with a depth through the lock of 21½ feet at high water springs, The comemrcial port and marine port lie between the west bastion and the inner harbors.

Communication.—By means of the railway at Flushing every part of Europe may be reached.

Signal stations.—A telegraph station and a Lloyd's signal station are established at Flushing. Storm signals are shown when necessary.

Repairs—Docks.—The Royal Shipbuilding & Engineering Co. "De Schelde," at Flushing, undertake repairing of steam and sailing vessels, and have at their command the most modern appliances for casting, turning, forging, etc. A vessel of 7,600 tons displacement has been built. The company possesses a crane of 50 tons lifting capacity and sheers of 70 tons.

There is a dry dock of the following dimensions belonging to the company, namely, 244 feet in length, 52 feet in breadth, with a depth of 13 feet on the sill at high water. (See Appendix.)

Supplies.—Fresh provisions can be obtained.

Coal.—About 4,000 tons of coal are kept in stock, and 70,000 tons are imported annually.

Time signal.—The signal is made from a stone tower on the western side of the lock of the outer harbor. Four black disks, 65 feet above the ground, are placed vertically at five minutes before signal and fall into a horizontal position at noon, Amsterdam mean time, or 21 h. 40 m. 28 s. Greenwich mean time.

Lifeboat.—There is a lifeboat station in the outer harbor.

Measured distance.—On the south shore of Walcheren Island, eastward of Flushing outer harbor, are two pairs of beacons, each surmounted by a cross, for the purpose of testing the speed of ships. The front and rear beacons bear 1° and 181° from each other, and the course between the pairs is 271° and 91°, distance 3,281 feet (1,000 meters).

Tidal signals are shown from a position between the inner and outer harbors to indicate the depths in the channel leading to the fishing boat basin. They are as follows:

By day: By means of balls and cones, each ball indicating a depth of 3¼ feet, and each cone an additional depth of 8 inches, thus:

Three balls (placed horizontally) above two cones signifies 11 feet.

A blue square flag indicates that the depth is 4 inches greater than is shown by the balls and cones.

When the depth in the channel is less than 4 feet a white square flag will be hoisted.

When the depth is greater than 13 feet the signal for 13 feet (4 balls) will be shown and the white flag will also be hoisted.

A red flag indicates that entry is prohibited.

By night: By means of white and green lights replacing the balls and cones, respectively, and having the same signification, thus;

Two white lights (placed horizontally) above three green lights signifies 8½ feet.

When the depth in the channel is less than 4 feet one white light alone is shown.

A red light indicates that entry is prohibited.

Walcheren Island is nearly circular and about 9 miles in diameter, with the seaport of Flushing at its south extremity and the town of Middelburg near its center.

The western coast of this island, forming the boundary of East Gat, just described, consists (with the exception of Westkapelsche Dyke), of a line of dunes, of which those to the eastward of Domburg and to southward of Zoutelande are higher than the others. The most conspicuous dunes from the Oosterhoofd, which is a bare dune, up to Westkapelle, are the Domburgsduin, on which there are several buildings; the Vrakhil, the Kœduin, and the Klinkersduinen. For the maintenance of the shore numerous stone dams and wooden groins have been built; at Westkapelle is a strong sea dyke. Westkapelle Mill stands on the Zuiderhoofd Dyke.

One of the most prominent objects on the island is the red stone lighthouse of Westkapelle, it being the old church tower of the hamlet, erected in 1470, and as a rule is visible out beyond the banks. Two mills and the smaller light structures are near it.

Within are the church towers of Domburg and Oostkapelle, of which the first named is high and pointed, the other broad. Farther inland is the steeple of Aagtekerke.

Southward of Westkapelle are some high dunes; thence, southward of a valley, stands the pointed tower of Zoutelande and a mill, while nearer to Flushing are the dunes of Valkenisse, Kaapduinen, and of Dishoek.

Middelburg is the chief town of the Province of Zealand. Its high pointed church tower is very noticeable and an excellent mark in clear weather, as it can be seen from outside the banks. Its trade is of but little importance; there are a couple of building yards, where small craft are built and other vessels repaired, and a dry dock.

Walcheren Canal.—The town is connected with Flushing, distant about 3.5 miles, by the Walcheren Canal and by rail. The canal is about 196 feet least width and has a minimum depth of 24 feet below canal gauge. The canal lock is 426½ feet in length and 65½ feet wide, with a depth on sill of 24 feet below the canal gauge, and permits vessels of 23 feet draft ascending to Middelburg, and proceeding out by Veere in the channel on the northeast side of Walcheren. There is a tug service on the canal.

Canal lights.—The lights shown on each side of the lock entrances and bridges for regulating the traffic through the Walcheren Canal will have the following signification:

Signal.	Signification.
Both lights red	Passage prohibited, lock gates closed.
One red, one green light	Passage prohibited, though gates may be open or closed.
Both lights green	Passage permitted, gates open. When this signal is displayed the gate at the other end of the lock will have a red light on it.
Two vertical red lights	Locking through is impossible.

Red lights will also be exhibited from poles on the lock heads at Flushing and at Veere when the passage through the locks is prohibited.

The dry dock at Middleburg is 413 feet in length, 65½ feet in breadth, with a depth of 15 feet on sill at high water ordinary springs. (See Appendix.)

River Schelde—Flushing to Terneuse.—Between Flushing and Borssele Point, about 5½ miles southeastward, on the north bank of the river, is the entrance to the Sloe, a passage separating Walcheren from South Beveland, and which, before the construction of a railway embankment across it, served as a means of communication between the West and East Schelde. The Kaloot Bank extends from the east side of the entrance to within ½ mile of the shore of Walcheren, off which banks also extend, leaving only a narrow channel at low water.

The channel is buoyed on the uniform system—red nun buoys on the east side and black can buoys on the west—for a distance of 3 miles. The Kaloot Bank is steep-to on its southwest side; its western extremity is marked by a red and black horizontally striped spherical buoy, No. 1, surmounted by a cylinder which indicates the entrance of the Sloe; No. 2, a black can buoy, marks the southwest edge of the bank, which is covered by a red sector of light from the front lighthouse on Borssele Point, and also by a sector of occulting red light from the west bastion at Flushing.

Borssele Point is steep-to and has two lighthouses on its southern part. The village of Ellewoutsdijk, on a point opposite Terneuse, lies 3.3 miles southeastward of Borssele Point.

On the south side of the river, opposite Flushing, is the small town of Breskens, which is a telegraph station. Fort Frederick lies midway between it and Nieuwe Sluis Rear Lighthouse. The village of Hoofdplaat is situated 4.3 miles southeastward of Breskens, and each place has a small harbor nearly dry at low water. About midway between Hoofdeplaat and Terneuse is an opening 1½ miles wide, which extends several miles inland to Philippine.

Buoyage.—Between Flushing and Antwerp all starboard hand light buoys exhibit occulting white lights and all port hand light buoys occulting red lights.

Banks—Buoyage.—The Schelde at Flushing is 2.3 miles wide, at Terneuse 2.7 miles, and between these places the width increases to 4 miles abreast the entrance to the Sloe. Large banks occupy a great part of the bed of the river; those southward and westward of the ship channel extend from off Breskens on the southern shore, to abreast Borssele Point on the northern shore, a distance of about 6½ miles. Though practically forming one bank, they are known by different names.

Spykerplaat, the northernmost of these (not to be mistaken for the ridge of the same name, 1.3 miles to the northwestward), dries over a length of 2.3 miles, the highest part being 6 feet above low water, and is fairly steep-to. The north side of the bank is marked by five red conical buoys; No. 1, a light buoy showing an occulting white light every 10 seconds—light 7 seconds, eclipse 3 seconds—lies off the edge of the shoal flat extending northwestward from the west end of the bank; the easternmost buoy, No. 4, lies off the northeast edge.

Plaat van Breskens, the western part of these banks, is narrow. Its northwestern end is marked by a buoy, and its southwest edge by a black can buoy. The northwestern end is covered by a sector of red light shown from Breskens.

Hooge Platen is the name given to the central part of the banks; it dries over nearly its whole extent, as much as 11 feet in one place, and is steep-to on its south side, which is marked by three black can buoys.

Hooge Springer is a continuation eastward of the Hooge Platen and is connected with the eastern end of the Spykerplaat. It dries 10 and 11 feet in places, and is steep-to on its east side, which fronts the Terneuse Channel. A light buoy, No. 5, exhibiting an occulting white light every 10 seconds—thus: light 7 seconds, eclipse 3 seconds—lies off its northeast end, and its east edge is marked by four red conical buoys, numbered 6 to 9.

Lage Springer, a bank about a mile in extent, lies southward of Hooge Springer, to which it is nearly joined. It dries 9 feet at low water springs. Its west and south sides are marked by five buoys, and a red and black horizontally striped light buoy, No. 10, is moored off its east extremity, showing an occulting white light every 10 seconds—thus: light 7 seconds, eclipse 3 seconds.

In winter No. 10 buoy will be replaced by a spar buoy painted in the same manner.

Philippine Channel.—**Savojaards Plaat** lies southward of the Lage Springer and nearly fills up the entrance of the inlet leading to

Philippine. The channel between the two banks, the southern part of which is named Biervliet Roadstead, is buoyed on the uniform system, the three eastern red buoys, numbered 2, 3, and 4, the second with a truncated conical topmark, and the latter with staff and ball, also serving to mark the southwest side of Terneuse Channel abreast No. 11, below mentioned. No. 4 is on the west side of the entrance to the Philippine Channel.

Nieuwe Polder.—The edge of the mud off Nieuwe Polder, on the south side of the Terneuse Channel, is marked by a red and black horizontally striped spherical buoy, with staff and diamond, No. 11, which also indicates the east side of the entrance of the channel leading to Philippine.

Suiker Plaat lies southeastward of the Hooge Springer, and is separated from it by Terneuse Channel. It dries from 2 to 6 feet on its west edge and 10 feet on the east. The southeast end is abreast Terneuse.

The bank is marked by buoys on all sides; a red and black horizontally striped spherical buoy, with staff and diamond, No. 3, lies off the northwest end; ½ mile southward of No. 3 the west edge of the bank is marked by a light buoy, No. 5, showing an occulting red light every 10 seconds; thus: light 7 seconds, eclipse 3 seconds. The steep southwest edge of the bank is marked by six black can buoys, numbered 6 to 11. Off the southeast end is moored a black light buoy, No. 12, showing an occulting red light similar in period to No. 5, marking the junction of the Everinge (west) and Terneuse Channels. In winter the latter buoy is replaced by a spar buoy similarly painted.

The northeast and east sides of the Suiker Plaat are marked by four red conical buoys, lettered from A to D, commencing from the westward. "B" buoy, with staff and ball, on the northeast side, marks the west side of the Rug van Borselen, the bar across the north end of the Everinge Channel.

Middel Plaat lies eastward of Suiker Plaat, separated from it by the narrow Everinge Channel; its south and southeast sides are marked by black buoys, one of which, No. 18, near the southeastern end, is a light buoy exhibiting an occulting red light every 10 seconds.

Borssele Range Lights.—There are two ranges at Borssele, consisting of two rear lights and one front light.

The front light for both lines is occulting, with white, red, and green sectors, exhibited, at a height of 21 feet, from a brown square framework tower, 13 feet high.

The rear light of the lower transit is fixed, with white and red sectors, exhibited, at a height of 39 feet, from a brown hexagonal framework tower, 33 feet high, situated 549 yards 109° from the front light. This range leads north of Spykerplaat.

The rear light of the upper transit is fixed, with white and red sectors, exhibited, at a height of 57 feet, from a red lighthouse, 32 feet high, situated 174 yards 354° from the front light. This range leads through the north part of Terneuse Channel.

Nieuwe Polder Light.—From a red iron structure, 29 feet high, on the point at Nieuwe Polder, south side of the river, is exhibited, at an elevation of 36 feet above high water, an occulting light with red and white sectors; the white light is visible 6 miles and the red light 3 miles.

Nieuwe Neuzen Range Lights are exhibited from Nieuwe Neuzen, westward of Terneuse.

The front light, occulting white, elevated 19 feet above high water, is shown from a red lighthouse, on a square iron base, situated on the dyke.

The rear light, 32 feet above high water, is shown from a red and white striped dwelling, 20 feet high, situated 459 yards 130° from the front light.

The lights in line lead partly through the Terneuse Channel.

Terneuse East Harbor Lights—West Jetty.—A fixed light, showing white, red, and green sectors, at an elevation of 43 feet above high water, is exhibited from a red iron framework, 33 feet high, situated 328 feet within the outer end of the west jetty at Terneuse.

Mole Heads.—A fixed light, showing white and green, is shown at each harbor mole head, from a black iron framework, 15 feet high; the western light is 19 feet and the eastern 22 feet above high water. When the harbor is impracticable a red light is shown under the white or green light.

Terneuse West Harbor Range Lights are fixed white, shown from gray steel masts.

The front light, elevated 22 feet, is exhibited on the west side of the lock; the rear light, elevated 29 feet, is situated 186° 110 yards, from the front light. These lights in line lead through the entrance.

Green fixed electric lights are shown at the outer ends of the piers.

Breskens Lights—West Mole.—From a black wooden post with white lantern and gallery, on the west mole head at Breskens, a fixed light is exhibited, at an elevation of 18 feet above high water, showing white, red, and green sectors.

East Mole.—On the east mole head, at a height of 11 feet above high water, a fixed white and red light is shown from a black and white post with diamond topmark. (See Light List.)

Hoofdplaat Light is fixed red, shown at a height of 7 feet above high water, from a red lamp-post on the head of the west mole at Hoofdplaat.

Channels—Depths.—The Honte is that part of the main channel of the Schelde from Flushing to Borssele Point, lying between the south shore of Walcheren and the steep south side of the Kaloot Bank on the north, and the Spykerplaat and Hooge Springer Banks on the south. From the channel are seen the church towers of East Souberg, about 1½ miles northeastward of Flushing, and of Rittem to the eastward, both with a small pointed roof. Near the latter stand a remarkable tree and a white mill.

The channel is about 1.3 miles wide at the western, and ½ mile wide at the eastern end, off Borssele Point, and has deep water throughout. The general depths in the western part are from 6 to 10 fathoms, with deeper water near the Walcheren shore; they increase toward the east to 17 and 18 fathoms in mid-channel off Borssele Point.

Terneuse Channel from Borssele Point to Terneuse is bounded on the west and south by the Hooge and Lage Springer Banks, the banks southeastward of the latter, and by the shore west of Terneuse; on the east and northeast by the Suiker Plaat. It has a width of 700 yards, with depths of 5½ to 7 fathoms, as charted, in the northern part, east of Hooge Springer; farther southward the water is deeper, and off Terneuse ranges from 6½ to 18 fathoms. This channel, together with the Honte, forms the main ship channel of the Schelde from Flushing to Terneuse.

Everinge Channel (West) eastward of the main or Terneuse Channel, is the broad continuation of the Honte, lying between South Veveland and the Suiker Plaat. A shoal of 16 feet water lies southwestward of the pier east of Borssele Point, and is covered by a red sector of light shown from that point. Almost opposite the point at Ellewoutsdijk, the channel divides, one part, the Oude Everinge, continuing eastward, while the other, the Everinge, turns southward between the Suiker and Middel Plaats, at the south end of which it joins the Terneuse Channel; it is only 400 yards wide. The north end of this channel has a bar named the Rug van Borselen, with a least depth of 14 feet at low water springs, subject to change; southward of the bar the water is deeper.

The channel eastward of Middel Plaat is also called the Everinge Channel; it is the continuation of the main channel from Terneuse Channel toward Antwerp.

Hoofdplaat Channel, the southern channel to Terneuse, is about ¼ mile wide, and lies between the northeast coast of Kadzand and the extensive banks lying off that shore. The depth in the western entrance is about 4½ fathoms, and halfway through the channel the depth is 5¼ fathoms, but elsewhere there are 7 to 13 fathoms in mid-channel. The eastern outlet into the Terneuse Channel, through the roadstead of Biervliet, is very narrow and only suitable for small vessels; the least depth is 19 feet at low water springs.

The channel to Philippine, named the Braakman, leads westward of Nieuwe Polder, between it and the Savojaards Bank; it is buoyed and has moderate depths for 3 miles, the least water in mid-channel being shown as 17 feet, but afterwards it becomes shoal; it is very narrow and only fit for small vessels.

Directions—Flushing to Terneuse.—From a position ½ mile south of the outer harbor at Flushing, steer eastward, leaving the red buoys of the Spykerplaat to starboard, and the Kaloot Bank buoys to port, until the tower of Ellewoutsdijk is open southward of Borssele Point, when steer toward it; pass about ¼ mile off Borssele Point, which has deep water close-to, and bring the two lighthouses on that point in range, 354°, over the stern, keep the range, leaving the red buoys of the Hooge Springer to starboard and the striped beacon buoy, and black light buoy on the Suiker Plaat to port until the Nieuwe Neuzen Lighthouse and striped dwelling (rear light) come in line bearing 130°, when steer for them. If these latter marks can not be made out, alter course to the southeastward when approaching No. 9 buoy of the Hooge Springer, and direct the course by the buoys. When Nieuwe Polder Point bears 200° alter course to the eastward for Terneuse, keeping in mid-channel.

By night a stranger should employ a pilot. These directions are offered for vessels having to move up river from Flushing Roads during bad weather, when that anchorage may be undesirable.

From off Flushing and within the eastern white sector of the occulting light at that place steer 99° until the white sector of light from the front lighthouse on Borssele Point bears 110°, when steer toward it on that bearing, which leads a little southward of the red sector of the same light, which should not be entered. When nearly abreast the red buoy showing an occulting white light at the northeast end of Hooge Springer steer more to the southward to pass Borssele Point about ¼ mile off, then alter course, passing westward of the buoy showing an occulting red light on the Suiker Plaat; when the fixed white range lights at Nieuw Neuzenpolder come into line bearing 130° steer for them, leaving a buoy with occulting white light to starboard, until the occulting light on Nieuwepolder Point changes from white to red bearing 203° 30′, or the fixed light on the west jetty at Terneuse also changes from white to red bearing 118° 30′ (which two changes should take place at the same time), when alter course toward the Terneuse Light, keeping on the junction of the red and white sectors until abreast of the Nieuwe Neuzen Lights, when alter course more to the eastward to keep in mid-channel. The lights on the mole heads at Terneuse show green downstream and white elsewhere.

Terneuse anchorage.—There is good anchorage on the north side of the channel opposite Terneuse, nearly out of the tide. On the south side of the channel the current is strong and the water much deeper.

Small vessels may find good anchorage in Biervliet roadstead, south of the Lage Springer, between can buoy No. 5 and nun buoy No. 1; there they will be out of the strong tidal current and well sheltered from northwest and southwest gales.

Terneuse Canal to Ghent.—Terneuse, situated about 12 miles from Flushing, on the oposite or south bank of the river, is connected with Ghent by a canal 18.8 inches in length.

There are two outer harbors, known as the east and the west harbors. There are two locks in the east harbor (east and middle lock) for inland craft. West harbor has one lock for seagoing vessels known as west lock. Vessels not exceeding 459 feet in length, 55.7 feet in breadth, and 26.2 feet draft are admitted to the canal. Vessels exceeding these dimensions can in some cases by special permission enter the canal.

Tides.—The high water interval at Terneuse is 1 h. 25 m., springs rise 15½ feet; at Liefkenshoek 3 h. 15 m., springs rise 16 feet.

Coal.—A small quantity of coal is kept in stock at Terneuse.

Ghent or **Gand,** situated at the junction of the Schelde and Lys rivers, is reached by the canal from Terneuse above mentioned; also by canal from Ostende.

The United States was, prior to the war, represented by a consul and a vice and deputy consul.

Trade.—The principal articles of export are scoria, phosphates, macadam, cement, coals, raw flax, rags, beet sugar, and potatoes; and the imports are timber, coal, flax, chemicals, pyrites, cotton, jute, machinery, etc. There is a regular steam trade to the east coast of England ports; also to Bristol and Glasgow.

Harbor and docks.—The outer harbor is 3,607 feet in length, 295 feet in width, with a depth of 21 feet, and is provided with cranes from 2 to 25 tons lifting capacity. The Commercial Wet Dock is 5,115 feet in length, 197 feet in width, with a depth of 18 feet, and has cranes of from 1½ to 15 tons. The timber dock is 820 feet in length, 393 feet in width, with a depth of 18½ feet. The wet docks, including the new construction, cover a total area of 289 acres.

The largest dry dock at Ghent is 426 feet in length, on blocks, by 42¾ feet in width, and has a depth of 17.8 feet on sill. There is also a smaller dock 248 feet long, on blocks, by 36 feet wide, with 14.3 feet on the sill. (See Appendix.)

Schelde, above Terneuse.—From Terneuse to Antwerp and above, the bed of the Schelde is occupied by numerous shifting sand banks, which with the traffic render the navigation somewhat intricate, so that to a stranger the aid of a pilot is indispensable. By a convention concluded between the Belgian and Netherlands Governments a number of light buoys have been placed to mark the channel of the river, and at various points lights have been established; further improvements in the lighting and buoyage are to be carried out. The ship channel is well buoyed, on the uniform system, viz, red buoys to starboard, and black buoys to port, when proceeding upward. The channels, and consequently the buoys and lights, are subject to frequent change, so that the charts can not always be implicitly relied on. Beacons and tide gauges are situationed at various parts of the river.

The ship channel to Antwerp will now be briefly traced; the light buoys only will be described; for the numerous shore lights the mariner is referred to the Light List.

Terneuse to Antwerp.—There is depth sufficient for all vessels up to the Bat Narrows. The Everinge main channel leads northeastward from Terneuse Channel, between the Middel Plaat and the Rug van Baarland, both of which banks are partly dry at low water. The southwest end of the Rug van Baarland is marked by a light buoy, with black and red horizontal bands, showing an occulting white light every 10 seconds.

A black light buoy, No. 18, exhibiting an occulting red light, is situated 1,400 yards west-northwestward of Eendragt Polder Lighthouse, and marks the western side of the entrance to Everinge Channel.

Two pairs of range lights on the south bank of the river eastward of Terneuse, and one pair on the opposite bank, northward of Baarland Point, guide those locally acquainted through the channel at night.

A telegraph cable crosses the river from Baarland Point to a point about 2½ miles eastward of Terneuse, the positions being marked by notice boards.

The Middel Channel or Gat is the continuation of the Everinge; it leads along the northern shore northward of Baarland Point, on which there is a light, and then turns eastward toward the entrance of the South Beveland Canal, curving round the Brouwer Plaat, which dries at low water. The navigation by night is facilitated by various lights on the west shore above Baarland Point, and at the canal entrance, and by a light buoy, No. 20, painted red, showing an occulting white light every 10 seconds, on the northwest side of Brouwer Plaat.

The South Beveland Canal, between Hansweert and Wemeldinge, forms the means of communication between the West and East Schelde. It is about 4.8 miles long in a north and south direction, with a width of 141 feet and a depth of 21 feet. Hansweert is a customs station for clearing vessels bound through the canal from a Belgian to a Dutch port.

The Zuider Gat is the continuation of the main channel; it extends from Hansweert in a southeasterly direction for about 4 miles, passing between the Walsoorden Plaat, which dries at low water and the shore to the westward, and then turns eastward for about 3½ miles to the entrance of the Bat Narrows, passing between extensive banks, dry at low water. The channel is very narrow in the curve off Walsoorden, and is indicated at night by sectors of light shown from Hansweert and from various lighthouses on the south bank, also by range lights. A red buoy, No. 23, showing an occulting white light every 10 seconds, lies abreast Hansweert, and a black buoy, No. 27, showing an occulting red light, off the northwest extremity of Walsoorden Plaat.

Wreck.—The wreck of a sailing vessel, with mast 15 feet above water, lies sunk in about 5 fathoms of water, with Magere Merrie Light bearing about 188°.

A black and red horizontally striped light buoy, No. 31, exhibiting an occulting red light, is established in the channel off Walsoorden; thence toward Bat Narrows two black buoys, Nos. 32 and 36, with occulting red lights, and two red buoys, Nos. 28 and 31, with occulting white lights, all with a period of 10 seconds, mark the channel at night.

Near No. 26 red buoy, in the northern part of the gat, a suitable anchorage will be found to await tide, on the west side of the channel; the least depth hereabout in mid-channel is 28 feet at low water springs, but only 18 feet on the nun buoy side and 20 feet on the can buoy side; farther southeastward, to the entrance of the Bat Narrows, the least depth is 32 feet at low water.

The Nauw van Bat (Bat Narrows) commences at the black light buoy, No. 40, which shows an occulting red light every 10 seconds, and trends toward Bat in an east-northeasterly direction for 2½ miles between the mud banks extending from the north shore and the Plaat van Saeftinge, which partly dries at low water. The channel is narrow and has one light buoy, painted black, with an occulting red light every 10 seconds, on the north side, and one light buoy on the south side, with an occulting white light every 10 seconds. The range lights at Bat lead through. The least depth in the channel is 27 feet.

Bat is a Netherlands customs station; vessels must anchor there if proceeding from Belgium to any of the ports in the West Schelde except Hansweert.

Telegraph station.—At Rilland, near Bat, there is a telegraph station, where messages relating to disasters, calling for assistance, etc., can be dispatched at all times.

Abreast Bat the channel, the depth in which is maintained by dredging, turns sharply to the southward along the east side of the

Plaat van Saeftinge, and from Bat to Fort Frederik, is 5 miles in length. At night it is navigated by means of range lights at Rilland, Bat, and Fort Frederik, together with three light buoys, the northern of which lies on the west side of the channel abreast Bat and shows an occulting red light every 10 seconds; another lies on the east side of the channel, halfway between Bat and Fort Frederik, and shows an occulting white light every 8 seconds; the third, a red buoy, is moored on the line of the Bat range, 2.3 miles 306°, from Fort Frederik Lights, and shows an occulting red light every 10 seconds. Two beacons stand on the east edge of the Saeftinge Bank, about 2 miles above Bat; the least depth of water in the channel between Bat and the beacons is 23½ feet, and between the beacons and the Doel Bank 22½ feet. Off Santvliet the channel lies between the east shore and Doel Bank. Anchorage may be had out of the tidal current off the northwest end of Doel Bank, near the last-mentioned light buoy.

The boundary between Belgium and the Netherlands strikes the river at about 2½ miles northward of the ruins of Fort Frederik Hendrik and Doel, respectively, being marked on the east side of the river by posts.

From Fort Frederik the channel for 2½ miles lies along the west bank past Doel as far as Fort Liefkenshoek.

Doel is the Belgian quarantine station; vessels passing upward must decrease speed for the visit of the health officer.

Liefkenshoek Road—Regulation.—When a vessel laden with explosives is lying in Liefkenshoek Road, a fixed green light is shown from Liefkenshoek Lighthouse, visible 1 mile up and down stream. When this light is exhibited, vessels passing must slacken speed.

A Belgian cutoms vessel is anchored off Lillo, opposite Fort Liefkenshoek.

From Fort Liefkenshoek and Lillo to Antwerp, a distance of 7½ miles, the course of the river is winding and becomes narrower as Antwerp is approached, the channel following the curve of the various bights. A red buoy, with occulting red light every 10 seconds, is moored off Kruisschans, and a similar light buoy lies off Krankeloon, ¾ mile eastward of Fort Phillip. Numerous lights are shown on both sides of the river from different points between Fort Frederik and Antwerp. (See Light List.)

Anchorage is prohibited in the narrow passes, curves, and in the channels with any of the range lights in line.

Ice breakers.—Two powerful tugs, specially constructed to serve as ice breakers, have been provided for the use of the port authorities.

The port of Antwerp is separated into two distinct divisions—(1) the river, extending for the length of the town, and farther, both north and south, bordered by quays; (2) the inner port, consisting of basins separated from the river by locks, which are subdivided into docks for ocean-going ships and docks for barges.

The port has a quay frontage on the Schelde River of 6,012 yards, eight large docks for ocean-going vessels at the north side, three docks for barge traffic at the south, a quay for petroleum ships, and several other smaller docks at the entrances of the larger docks.

The quay space on the Schelde River is principally assigned to companies having lines of steamers trading regularly to this port, and vessels whose draft of water would not permit of their entering the docks. The amount of space for vessels drawing 24 feet is 3,281 yards; for those drawing 20 feet, 2,187 yards. The depth of water alongside the principal quay walls varies from 27 to 30 feet at low tide. The quays are all furnished with hydraulic cranes of 1½ and 2 tons power, being for the most part of the whole-arch pattern, while those which have been recently constructed on the south quays are on the half-arch system. On the eastern quay of the Kattendijk Basin are electric sheers of 120 tons lifting power. There is an electric crane of 50 tons, one of 30 tons, and also five hydraulic cranes of from 10 to 40 tons.

The roadstead of Antwerp, in close proximity to the city, and directly opposite the quays for a large part of its distance, affords suitable and safe anchorage ground to vessels; and the mooring arrangements, covered sheds, cranes, the railways which run alongside the quays and many of the docks to facilitate inland transport, and indeed all the contrivances of modern invention, have been added to the port and combine to make it one of the best equipped ports in existence, favored as it is by its geographical position.

The limit of the road has been extended to the southward and is now about 1,200 yards above the new southern quay.

Depths.—Vessels of almost any draft can ascend the Schelde to Antwerp.

Harbor accommodation—Docks.—There are fourteen or more wet docks.

The Kattendijk is 3,116 feet in length, 459 feet in breadth, with a depth of 23 feet at high water springs, on the sill, and 23½ feet in the dock; it is entered directly from the Schelde by a lock, 328 feet long, 220 feet broad, with a depth on the outer sill of 10⅙ feet at low water.

Klein Dock is also entered direct from the river by gates, with 8⅓ feet on the sill at low water. Groot or Grand Basin, with a depth of 20¾ feet, is entered from it.

The Lefebvre and America Basins are 36¼ feet in depth and are connected by a passage 29¾ feet deep. Lefebvre Basin is connected with Kattendijk Basin by a lock.

The Mexico Basin or Hout Dock, which is entered from Kattendijk Basin, has a depth of 27½ feet; La Campine Basin or Kempische Dock has the same depth; Asia Basin has 23 feet. The two latter basins are entered from Mexico Basin, and all have 23 feet on the sills.

The intercalary basins or docks, opened in 1907, are in the form of a "Y," the entrance from the Lefebvre Basin being at the base and the arms projecting at a right angle. They have together an area of 68¾ acres, with 3,279 yards length of quayage. The northwestern arm, named Bassin Canal (which will eventually form the commencement of the canal dock under the port-extension scheme referred to below), is 814 yards long and 273 yards wide; the northeastern arm, or Première Darse, is 711 yards long and 197 yards wide. The entrance or junction between these new docks and the Lefebvre Basin is 383 yards in length, with a width at either end of 98 yards, but toward the entrance of the latter basin it is narrowed to 172 feet. The depth of water in these basins is 30½ feet alongside the quays and 33¾ feet in the center. The quays will be furnished with 80 electric cranes. The entrance from Lefebvre Basin is open. There is water communication between all the basins on the north side of Antwerp.

A new lock gives direct communication between Lefebvre Basin and the river. It is 580½ feet in length, 79 feet in breadth, with a depth on sill of 33 feet at high water, and is divided into two compartments of 337 and 243 feet, which can be used separately or together. Vessels drawing 30 feet of water can enter the basins through this lock, which has received the name of Royers Lock.

Graving docks.—There are ten graving docks, the largest of which is 503 feet in length, 77 feet in breadth, with 22¼ feet water on the sill.

A new dry dock is at the end of the Lefebvre Basin; it is about 672½ feet long, 82 feet wide at the entrance, with a depth of water 28¾ feet.

With the large intercalary docks Antwerp, not including the vast extension scheme under construction by the Belgian Government, possesses docks which will favorably compare with those of any other port.

The total area of the docks, including the intercalary docks, amounts to 1,109,116 square yards, the depth in which ranges from 15½ feet for the barge docks to upward of 30 feet of water in some of the docks allotted to vessels of larger tonnage. The amount of basin quay space for vessels drawing 24 feet is 6,350 yards; for those drawing 20 feet, 9,945 yards.

The total length of quay space in river and basins amounts to 23,785 yards. (See Appendix.)

New works.—Extensive works have been under construction for the improvement and extension of the port of Antwerp. Some of them were, under normal conditions, to have been completed in 1914.

A canal, 5 miles in length and 890 feet in width (1,310 feet in certain places), is to be cut from Kruisschans, about a mile above Lillo, to Antwerp, joining the northwest wing of the new intercalary docks, and nine oblique basins will branch off from its east side, each 3,900 feet long and 700 feet wide. Five dry docks will also be constructed at Kruisschans; another at Anstruweel.

The depth of the canal and subsidiary basins will be 40 feet.

There will be three locks at Kruisschans, each 975 feet long, 98 feet wide, and 39 feet deep.

Antwerp, the chief port of Belgium, is upon the right or east bank of the Schelde, 12 miles above the head of the delta, and 50 miles from the sea. The numerous public buildings of Antwerp, chief among which is its celebrated cathedral, give a highly picturesque appearance to the city. The population of Antwerp and suburbs is about 313,000. The United States was, prior to the war, represented by a consul and a vice and deputy consul.

Repairs and supplies.—Every description of repairs to steam or sailing vessels, by skilled workmen, can be effected. Stores of all kinds may be obtained.

Hospitals.—There are two public hospitals at which sailors can be received when ill.

Coaling.—Vessels can lie alongside the quay, and the coals are brought either in lighters or by railway trucks. At low water there is a mean depth of 27 feet. About 3,500 tons of coal are kept in stock.

Prohibited anchorage.—Anchorage is prohibited in the south part of the roadstead of Antwerp over a space about 1,100 yards in length, to allow of the maneuvering of large vessels. The prohibited space is marked by a beacon at each end, carrying a notice board, and also by a line of four white buoys lying near the left shore.

Quarantine regulations.—All vessels arriving in Belgian territorial waters, until admission to pratique, or if placed in quarantine, must display the following signals:

By day: A yellow flag or the national flag in the mizzen shrouds or where it can best be seen.

By night: A green light, visible all around the horizon from a distance of 1 mile, in addition to the ordinary navigational lights. In sailing vessels this light is to be shown from where it can be best seen, but at a height of at least 13 feet above the side lights. Coasting vessels, carrying only one white light, will hoist the green light at least 6 feet above that light.

On all steamers the green light will be hoisted at least 13 feet vertically above the masthead light.

Vessels at anchor display the green light at a height of at least 13 feet above the anchor light.

If, under circumstances of absolute necessity, such as storms, drift ice, etc., the examination of vessels can not be made at the sanitary station of Doel, in the Schelde, there will be hoisted a red flag by day and a red light at night at the flagstaff of the quarantine station at Doel on the left bank. Vessels submitted to sanitary measures may in this case pursue their way to Antwerp without stopping at Doel.

Vessels with explosives on board, navigating the Schelde, are required at night to exhibit three lights vertically, the middle one red, the others white, in addition to the ordinary lights.

Port regulations—Explosives, etc.—No gunpowder shall be kept on board any ship, vessel, or craft whatever; it shall be discharged immediately on arrival and disposed of as the marine surveyor shall direct. The charge for its deposit shall be paid at the pilot office.

Vessels laden with raw petroleum, naphtha, benzine, or other product of this description, shall enter the nature and quantity of these goods they have on board before they can obtain leave to take a berth.

Vessels laden with a cargo of the above-mentioned description can not obtain leave to enter the docks or moor alongside the river quays.

The south quay of the Old Dock is the only place where vessels are allowed to load or discharge raw petroleum, etc.

Special signals.—A vessel dropping down the river with the current, with the anchor down, or with the help of a tug, in order to go into dock or alongside one of the quays, shall give, every two minutes on her whistle, siren, or foghorn, four short blasts, followed by one long blast at one second after the last short blast.

This signal shall be made by steamers under steam by means of the steam whistle or siren, whether being helped by a tug or not.

Steamers not under steam, and sailing vessels when not helped by a tug, shall make this signal by their foghorns.

The tug which is helping a steamer not under steam, or a sailing vessel, shall make this signal on her steam whistle or siren.

On certain portions of the Schelde River vessels under way which, on account of their great length or deep draft, have difficulty in keeping out of the way of other vessels may, provided they are in charge of a licensed pilot, and by his advice, carry the following special signals:

By day: At the foremast head, a black cylinder, at least 2 feet 1½ inches in diameter, and at least 3 feet 4 inches in height.

By night: A red light at the foremast head, visible all round at a distance of 2 miles, placed at least 13 feet above the masthead light, or 13 feet above the upper masthead light, if there are two.

A vessel towing or assisting a vessel carrying one of these signals must also show it, but the red light shall be placed at least 3 feet 4 inches above the upper masthead light.

Every vessel under way that does not carry one or other of these signals must keep out of the way of the vessel showing them.

If two vessels are meeting, both of which carry special signals, they obey the ordinary rule of the road.

The portions of the Schelde River in which the signals may be shown are:

(*a*) Between the northern limit of the green sector of Magere Merrie Light, bearing 239°, and the upper limit of the road of Antwerp.

(*b*) In the Sardijngeul, from a line drawn in a northeast by north and southwest by south direction through the point of intersection of the lines of Westkapelle-Zouteland Range Lights and those for the Sardijngeul, shown from Flushing to a line drawn through the fixed white light on the end of the west jetty, Commercial Port, and the red and green fixed light on the west jetty head of the Outer Harbor, Flushing.

Should one of the above signals be carried, it must be shown as soon as the vessel enters one of the portions of the river just described and kept up as long as she is under way within it. Vessels leaving Antwerp must show it as soon as they leave the quays or come out of the basins.

In order to carry these signals in the Belgian portion of the river vessels must exceed 426½ feet in length or have a draft of at least 26¼ feet. In the Netherlands portion of the river the length and draft are determined by the pilot board in connection with the condition of the channels.

Time signal.—On the tower of the Government building in the Zelande Corn Market is the time signal, consisting of four disks on a mast, from which the time is signaled daily. The disks are placed perpendicularly at five minutes before the signal, and fall into a horizontal position at 1 h. 00 m. 00 s. p. m., and at 1 h. 15 m. 00 s. Greenwich mean time, by electricity from the Royal Observatory at Brussels. If for any reason the time thus signaled is inaccurate, a ball will immediately be hoisted at the masthead.

Trade.—The trade of Antwerp is extensive, and consists chiefly of hides, coffee, sugar, cotton stuffs, metals, tobacco, wood, ivory, cereals, rice, margarine, beet sugar, chemical products, petroleum, wool, provisions, and other manufactures, a large proportion of the latter being forwarded to various parts by means of canals and railways.

Brussels.—A port, consisting of three basins, is under construction at Brussels. This is connected with Antwerp by the Willebroeck Canal and the Rupel and Schelde Rivers.

At present only vessels of 9-foot draft can ascend to Brussels, but the canal is being deepened to 18 feet, and eventually to 21⅓ feet with three locks, each 374 feet long, 52 feet wide, and having a depth of 21¼ feet on the sill.

Communication is carried on by steamers in normal times to all the chief ports of the home trade, of which several ply between Antwerp and Harwich, Hull, and London. There are direct lines to the Plate River, Brazil, New York, West Indies, Australia, China, Mediterranean, Black Sea, Sweden, San Francisco, the ports of the Low Countries and other places. Railroads connect Antwerp with all parts of the Continent, and the telegraph with all parts of the world. The telegraph office is always open.

Tide.—The high-water interval at Antwerp is 3 h. 35 m.; springs rise 15 feet. The flood current lasts five and one-half hours, with an average velocity of 1½ knots; the ebb lasts six and three-quarters hours, with an average velocity of 1¾ knots an hour. The currents turn half an hour after high and low water.

CHAPTER III.

THE EAST SCHELDE TO GOEREE.

The East Schelde—General remarks—Depths.—The East Schelde is separated from the West Schelde by Walcheren and the northern sides of North and South Beveland Islands, and lies between those islands and that of Schouwen. There are several banks in its approach and in the entrance, through which there are two channels. The main and southernmost is the Roompot, which is buoyed, and the northern, the West Gat, not often used.

There are depths of 4 to 5 fathoms in the fairway of the approach as charted, and the water within is deeper up to and beyond Zierikzee Road, except abreast Veergat, but the channel is subject to change, and the buoyage therefore can not be implicitly relied on.

At about 16 miles above its entrance and 3 miles above Zierikzee the river is divided by Tholen Island.

The town of Bergen-op-Zoom is situated at the head of the East Schelde proper, the southern branch, some 25 miles above its entrance. Southward of that town the river is separated from the West Schelde by an embankment over which runs the railway.

The northern branch, under the names of the Keeten, Mastgat, and Zype, leads between Schouwen and Tholen Islands into the Maas, about 9 miles above Brouwershaven. The Keeten and Mastgat are deep throughout; the Zype has a depth of 20 feet at its junction with the Maas.

The least depth in the ship channel between the sea and Dordrecht, entering by the East Schelde, a distance of 55 miles, is 8 to 9 feet at low water, and 18 to 19 feet at high water springs, in the West Hellegat, westward of Willemstad, but is subject to constant change.

Aspect.—The entrance to the East Schelde has little to distinguish it, except the lighthouses on either side. From Westkapelle the northwest side of Walcheren is skirted by moderately high sand hills, upon which are several signal stations, while a short distance behind appear the churches of Domburg and Oostkapelle. The church of Veere, in Veergat, east side of Walcheren, is distinguished by a dome which, together with the spire of the town hall, is visible from the Roompot. From every direction, at a short distance off Walcheren

Island, the spire of Middelburg shows well above all other objects, and forms a good landmark. The coast of North Beveland is low, with trees here and there, and is protected by a dyke. The tower of Wissekerke, 3 miles from the west end of the island, stands ¾ mile from the shore, with a mill north of it; and near Kolynsplaat on the northeast point are two mills, the eastern of which is a good mark.

Schouwen Island, on the northern side of the East Schelde, has at its northwest end many sand hills, some of which, named the Woolpacks, are long and white; the others appear as green hummocks. Among them stands West Schouwen Lighthouse, a prominent object; the high tower of Koudekerke stands on the shore 2½ miles eastward of the southwest point of the island; about 1½ miles northwestward of Koudekerke stands the tower of Burgh, with a short spire, and the church at Haamstede ½ mile to the northeast of it. About 2.8 miles eastward of Haamstede the tower of Serooskskerke stands in a clump of trees, and farther to the southeast are the mills of Moriaanshoofd and Flaauwers. In clear weather the tower of Zierikzee Church at the south end of the island, may be seen at a considerable distance.

Kolynsplaat Light is fixed white, exhibited, at a height of 21 feet, from a post on the north pier in the harbor of Kolynsplaat. (See Light List.)

NOTE.—The light shows only inside of the harbor during the present war.

Burgsluis Light.—From an iron framework, painted brown, with gray lighthouse, 35 feet high, situated on the dike at the harbor mouth, is exhibited a fixed red and white light, elevated 40 feet above high water.

Schelphoek Light.—A fixed white lantern light is shown from the east molehead at Schelphoek, about 2 miles eastward of Burgsluis.

Zierikzee Light is fixed red and white, exhibited from a yellow dwelling on the west jetty head at Zierikzee, and is elevated 43 feet above high water.

Val Light is fixed, with white, red, and green sectors, exhibited, at a height of 31 feet, from a black iron framework, 23 feet high, on the dike about 1 mile eastward of Zierikzee Harbor. (See Light List.)

Banks in the approach.—The Rabs, the Schar, and other banks to the westward have been described elsewhere.

Schouwen Bank is nearly a continuation of the Schar to the northeastward, and is opposite to Brouwershaven Gat rather than the East Schelde, and from 11 to 12 miles offshore. There are several smaller but deper banks outlying it. The Schouwen, within the 10-fathom curve, is a ridge 13 miles in length in an east-northeast and opposite direction, and from ½ mile to 1 mile in breadth. In its northern portion depths of 3⅔ to 5 fathoms will be found over a length of about 3 miles, and between it and the southern end of the Schouwen there are patches of 4¼ to 5 fathoms.

From the shoalest spot of 3⅔ fathoms West Schouwen Light bears 115°, distant 11½ miles.

The depths around the bank are from 12 to 15 fathoms, white and brown sand, with black specks and shells.

The bank is so narrow in places and also steep-to that unless the lead is hove rapidly it may be passed over unnoticed; it is, however, generally marked by tide rips.

A series of ridges with from 6 to 8 fathoms upon them extend northeastward of Schouwen Bank to abreast Brielle Gat. One patch (the shallowest) of 5 fathoms lies 4 miles eastward from the north end of the shoal portion of Schouwen Bank.

Schouwen Bank Light Vessel.—The Schouwen Bank Light Vessel, painted red, with a broad white streak, and having the name "Schouwen Bank" on her sides, is moored in 14 fathoms, within the inshore edge of the bank, 1.3 miles, 99°, of the shallowest spot.

By day a black ball is carried at the masthead. The vessel also has a jigger mast.

From the light vessel West Schouwen Lighthouse bears 118°, distant 10 miles.

The light is a group flashing white light, elevated 36 feet above the sea, and should be visible 11 miles. A riding light is also shown.

The light during bad weather is lowered 5 feet. When from any cause the flashing light can not be exhibited, a fixed white lantern light will be shown from the masthead, and a white flare every 10 minutes from above the gunwale. When the light vessel is not in station the usual lights will not be exhibited, but a fixed red light will be shown at each end of the vessel. By day a red flag will be hoisted above the black ball at the masthead.

Should a vessel be seen standing into danger, a gun will be fired and repeated if necessary; also the signal flags J D of the International Code, signifying "You are standing into danger," will be hoisted and kept flying until answered.

A rocket immediately after a gun denotes that those on board require assistance from the shore.

Caution.—It should be borne in mind that not only this vessel but many other aids to navigation are not now in their positions, having been withdrawn on account of the war. They are described in this volume because it is hoped that they may soon be restored to their former positions. In some of the positions of former light vessels, light and whistle buoys have been placed.

Watch buoys.—Two nun watch buoys, painted red and white in horizontal bands, and the letters S. B. No. 1 and 2 on them, respectively, are moored on the eastern edge of the bank between it and the light vessel, about 1.3 miles apart. They are for the purpose of enabling the vessel to be put back into her position should she break adrift. (Temporarily withdrawn, March, 1918.)

Fog signal consists of a siren. If the siren is out of order, an auxiliary fog signal will be made on the bell, immediately followed by two short blasts from the hand foghorn.

A submarine bell is sounded aboard Schouwen Light Vessel.

Tidal currents.—The direction and velocity of the tidal currents at Schouwen Bank Light Vessel are as follows:

Time of tide at Dover.	Tidal current at light vessel.	
	Direction.	Velocity.
		Knots.
5 hours before high water	Slack turning from N. by W. to W. by S.	0 to ¼
4 hours before high water	SW. by W. ½ W	½ to 1
3 hours before high water	SW. ½ W	¾ to 1¾
2 hours before high water	SW	1 to 2
1 hour before high water	SW. by S	1 to 2
High water	S. by W	¼ to ¾
1 hour after high water	Slack turning from S. by E. to E. by N.	0 to ½
2 hours after high water	NE. by E	1 to 2
3 hours after high water	NE	1¼ to 2¼
4 hours after high water	NE. ½ N	1½ to 2¾
5 hours after high water	NNE. ½ E	1 to 1½
6 hours after high water	North	¼ to ¾

Middel Bank, situated 2 miles within and parallel to Schouwen Bank, is the continuation of the Rabs to the northeastward, and lies across the entrance of the East Schelde, as it extends northeastward to nearly abreast Brouwershaven Gat. This bank is 14 miles in length by about 1 mile in breadth, except at its west extremity, which is irregular in breadth and depth. The shallowest parts are toward its extremities. At the western end there are patches of 4 fathoms, and at the eastern end is one patch of 3½ fathoms, but over a space nearly 8 miles in length between these shallow parts there are depths of 6 and 7 fathoms.

Steen Banks lie 2 miles within Middel Bank, across the entrance to the East Schelde. They consist of a ridge within the 10 fathoms curve, extending southwestward from Schouwen Island, varying in breadth from ½ to 1.3 miles.

The Noord (North) Steen Bank is 7 miles from the coast of Walcheren, and has as little as 2½ fathoms on it. The Zuid (South) Steen consists of several shallow patches, with a least depth of 3½ fathoms; its eastern patch lies about 2 miles southwest of the North Steen Bank, the depths between varying from 4 to 9 fathoms. The banks are steep-to in places, and the depths within and without it are from

12 to 15 fathoms. They consist of hard sand with black specks or broken shells in it in places; outside the bank the bottom is mud, sand, and shells, and in Steen Deep, within, it is fine gray sand and sand and shells. The banks are generally marked by tide rips.

From the depth of 5 fathoms upon the west end of the banks Westkapelle Tower bears 128°, distant 8.5 miles, from which point their general direction to the like depth at the east end is 54° for 8 miles.

The Swatchway is 1 mile wide, with from 5 to 8 fathoms in it, the mark through which is Middelburg Church spire and Domburg Church in line 131°. In calm weather the water ripples over the Steen Banks, but in stormy weather it breaks heavily.

Range marks.—Middelburg Church spire in line with Domburg Church, 131°, leads between the Schar and Schouwen Bank. West Kapelle Lighthouse in line with the light on the dike, 150°, leads over the south end of Schouwen Bank and over the Middel Bank in not less than 7 fathoms.

Both marks lead between the Steen Banks, the former toward the entrance to the Roompot, the south channel of the East Schelde; the latter toward the entrance to East Gat.

Middelburg and Oostkapelle Churches in line lead northeastward of the shallowest parts of the Steen Banks.

Buoys.—A black and white conical buoy, horizontally striped, with staff and white ball, and marked Z. Steen Bank, is moored on the western edge of the Zuid (South) Steen in 11 fathoms, with Westkapelle Lighthouse 128°, distant 8.8 miles.

Between the two Steen Banks, in 8½ fathoms, about 670 yards westward of a 4-fathom patch, is a red light and whistle buoy named Midden Steen Bank. It is marked M. S. B. and exhibits an occulting white light every 10 seconds; thus: light 7 seconds, eclipse 3 seconds. It lies with Middelburg Spire 132°, in line with Aldenbruk House at Domburg, the latter distant 7.8 miles.

Steen Bank—Watch buoy.—A red conical buoy is established at 200 yards eastward of Midden Steen Bank light buoy.

A white conical buoy with staff and red ball and marked N. S. B. is moored in 6 fathoms off the northeast end of the Noord Steen Bank, 1½ miles 45° from a depth of 16 feet, and 301° 2 miles from the southern Bol patch of 6 feet on the North Banjaard Bank.

Steen Deep, between Steen and Kaloo Banks, has depths ranging from 12 to 16 fathoms. It narrows at its north end and becomes shoaler, the depths between it and the Banjaard being from 7 to 9 fathoms. The holding ground is good; it was formerly known as Walcheren Road, but it is probably never now used as an anchorage.

The best entrance to Steen Deep is through the swatchway marked by the Midden Steen light buoy, with Middelburg and Domburg

Churches in line 131°, or at night with Westkapelle Lights in line, but the latter should scarcely be attempted without local knowledge. If intending to anchor, do so before the water shoals to less than 8 fathoms.

Tidal currents in the East Schelde.—Off the gats of the East Schelde the tidal currents have the same rotary motion as those off the gats or channels of the West Schelde.

The tidal currents in Steen Deep are rotatory in character and turn against the movements of the hands of a watch. At six hours after high water at Dover the current is slack, or nearly so, and shortly after it commences running to the westward, increasing gradually in strength as it shifts to the southward, being at its maximum when running in a south-southwest direction, three hours before high water at Dover. Continuing to shift to the southward it finally ceases when running in an easterly direction about the time of high water at Dover. After high water at Dover the current begins to run to the northeast by east, gradually shifting against the movements of the hands of a watch, and increasing in strength until it reaches its maximum velocity at three hours after high water at Dover, in a north by east direction, and finally ceases at about six hours after high water at Dover, by which time it has shifted gradually to a westerly direction.

In the Roompot the flood runs at the commencement toward the shore, the same as in the Wielingen, but inside Oostkapelle its direction follows the coast.

Also in the Roompot the flood and ebb run in and out about two hours longer than in Veergat on the other side of the Onrust, making the latter part of the ebb of the Roompot the first of the flood in Veergat.

In Veergat the tidal currents run fairly in and out, being hemmed in by flats, and the ebb, uniting at the Onrust with that of the East Schelde, runs along by Oostkapelle and Domburg, where it is again joined by the current through East Gat, and the united currents proceed about northwest by north to the sea. In the same manner the flood current divides at this spot, running partly into the Roompot and partly into East Gat. This divergence and meeting of the flood and ebb produce those eddies which have formed the irregular ground of the Kueerens.

Within the point of the Noordland Bank, at the inner extremity of the South Banjaard, the first of the flood takes its direction over the Neeltje Jans; and in like manner the first of the ebb draws northerly over the banks, on which account, both in going in and coming out, it is necessary in sailing vessels to be guarded against this influence in light winds and calms.

In the East Schelde above Zierikzee the ingoing current runs with considerable force through the Keeten and Mastgat Channels, on the south side of Duiveland, and continues running in until about five hours after high water at Dover, notwithstanding the fact that the current north of Duiveland commences to run out through Brouwershaven Gat two hours previously.

The Roompot (lat. 51° 36′ N., long. 3° 33′ E.), the principal entrance into the East Schelde, is formed between the coast of Walcheren and the South Banjaard Bank. In its approach the depths are from 4 to 5 fathoms in the fairway, with deep water above No. 2 buoy as far as Zierikzee, except on the bar abreast the entrance to Veergat, where the depth in the fairway is 15 feet, subject to change.

South Banjaard Bank.—The North and South Banjaard are extensive flats, encumbering the entrance of the East Schelde.

The South Banjaard separates the West Gat from the Roompot, and its eastern portion, named the Noordland, dries 7 feet at low water, but the depths gradually increase toward the west extremity of the bank.

Southward of the Noordland lie several patches, dry at low water, and farther southward are other banks, the eastern of which, named the Hompels, has depths of 2 to 6 feet upon it. From the center bank, which has 15 and 16 feet on it, the bar above mentioned extends southward across the Roompot to the Schaar van Onrust.

Onrust is the bank extending westward from the northwest point of North Beveland; from its north side the Schaar projects in a west-northwest direction.

Rassen.—Westward of the South Banjaard is the Rassen, a flat of irregular depths with two patches of 17 and 19 feet, respectively, on it.

The Breezand extends from the north shore of Walcheren from Veergat to a little beyond Oosterhoofd; from it a spit extends westward for 3 miles toward the Domberger Rassen, with 12 feet near its extremity, leaving a narrow inlet named the Urk between it and the shore.

Middelplaat, lying eastward of the South Banjaard, is a narrow and shallow bank which extends northwest and southeast. On its southeast end are some patches which dry at low water.

On the southwest side a spit projects southeastward into the Roompot.

The channel between the South Banjaard and the Middelplaat is 670 yards wide at its north end, and has depths of from 4 to 7 fathoms as charted. It forms the best means of communication between the West Gat and the Roompot, but must be navigated entirely by means of the lead and the sight of the banks, as it is unbuoyed. The tidal currents run strongly through.

Neeltje Jans and Roggenplaat.—Eastward of the Middelplaat and separated from it by a narrow channel with 12 feet least water at its south end are the Neeltje Jans and Roggenplaat, extensive banks on the north side of the channel leading to Zierikzee; they dry at low water over the greater part of their extent and are intersected by narrow channels. They are steep-to except on the northwest side.

Nunnenplatje lies eastward of the Roggenplaat, nearly in the center of the Hammen Channel, and partly dries at low water.

Vuilbaard lies southward of the Roggenplaat, and between Zierikzee Harbor and the northeast part of North Beveland. It consists of two banks, of each of which a small part dries at low water. In the channel between the two banks, and also in the Schaar van Kolynsplaat between the southern bank and North Beveland, the depths are more than 5 fathoms of water. The channel between the northern bank and the Roggenplaat is deep. A flat extends off the west and east ends of the northern bank; otherwise they are both steep-to.

North Banjaard Bank extends 7½ miles in a westerly direction from Schouwen Island and its north edge is the south side of the entrance to Brouwershaven. This extensive sand is steep-to on its outer side, and is shallow throughout. On the north side are the Nieuwe Zand and Wynbol. These and a considerable portion at its southeast end, named Zee Honden Plaat, and the Petroleumbol to the westward of the latter, and the Krabben Plaatje near the island, dry at low water. The western shallow portion of the North Banjaard is named De Bol, two patches with 6 feet water.

The southwest point of the bank is reported to be extending.

There are several swashways through the North Banjaard, available for small local coasters and fishermen; and between it and the island is Krabben Gat, with depths of 6 to 7 fathoms in places, but its north and south entrances are barred by flats with depths over them of 8 and 16 feet, respectively.

Clearing marks.—The mill at Zuiderhoofd well open of the lighthouse at Westkappelsch Dyke leads westward of the southwest end of the North Banjaard by day. The flashing light at Westkapelle in sight leads westward of it at night, but the line of obscuration leads inside the buoy.

Buoys.—The following buoys mark the sea face of the North Banjaard Bank.

South Banjaard, a black light buoy, showing an occulting white light, marked "Z. Br.," lies off the southwest end of the North Banjaard Bank.

A black and white conical buoy, surmounted by a cylinder and marked "W. Bjd.," marks the west side of the bank about 2 miles east-northeastward of the South Banjaard light buoy.

Oost (East) Banjaard, a white nun buoy marked "B. Jd.," with a diagonal cross as topmark, lies in 8½ fathoms, about 1.3 miles 20° of the northern Bol patch, of 6 feet, with West Schouwen Lighthouse 88°, about 7 miles.

Roompot Channel buoyage.—Red conical buoys mark the starboard side of the Roompot Channel on entering, and black can buoys the port side.

No. 1, red conical with staff and ball, the outer buoy, is placed about 1¼ miles northeast of the Kueerens, in about 4 fathoms. There are no other red buoys for about 6 miles until abreast Veergat, where the red buoys Nos. 2 and 3, lying in a northeast line, mark the northwest side of the Schaar von Onrust and the south side of the bar of the Roompot. No. 4 buoy lies southeastward from No. 3, on the north side of Onrust. Nearly 5 miles farther eastward, No. 5, spherical, red and black horizontally striped, with staff and diamond, lies off the west point of the North Vuilbaard. Nos. 5a, 6, 7, with staff and ball, and 8 mark the north and northeast sides, and No. 9, spherical red and black horizontally striped, with upright cross, is moored off the east point of the same bank. No. 10 buoy is moored off the northeast side of the South Vuilbaard abreast the harbor of Zierikzee.

The outer black buoy No. 1, with staff and truncated cone, lies about a mile eastward of No. 1 outer red buoy, and about 2¼ miles westward of the Rassen 17-foot patch. No. 2 marks the south edge of the Rassen, and Nos. 3 and 4 the south edge of the South Banjaard. Nos. 5 and 6 black buoys, the latter surmounted by a truncated cone, are moored on the southeast edge of the South Banjaard and mark the north side of the bar of the Roompot. No. 7 lies off the southeast point of the Hompels; and No. 8, with staff and truncated cone, marks the extremity of a spit with 19 feet on it extending southeastward from the latter. No. 9 (Schaaps Kooitje) lies at the extremity of the spit extending into the channel from the Middelplaat, and Nos. 10 to 13 (the latter named Schouwsche) mark the south edges of Neeltje Jans and Roggenplaat. No. 14, spherical, red and black horizontally striped, with staff and cone, lies off the southeast point of the latter bank.

Light buoy.—Black can light buoy, No. 2, exhibits an occulting red light every 10 seconds, showing thus: Light 7 seconds, eclipse 3 seconds.

The channel between the two Vuilbaard Banks is marked on the north side by two black can buoys and a spherical red and black horizontally striped buoy No. 9, surmounted by an upright cross, and on the south side by two red conical buoys.

Schaar van Kolynsplaat.—There is a depth of 17 feet at the western entrance to this channel.

The Schaar van Kolynsplaat has five red conical buoys on its south side marking the shore bank, and three buoys on the north side on the South Vuilbaard, of which No. 1, spherical, is striped red and black horizontally, with staff and diagonal cross, moored near the west end of South Vuilbaard; the others are black can buoys.

West Gat, the northern entrance to the East Schelde, lies along the south sides of North Banjaard Bank and Schouwen Island, and is bounded on the south by the South Banjaard and the north and northeast sides of the Middelplaat. Its least width is ¾ mile at the eastern end. The depth on the bar in the entrance, which is 1½ miles wide, between the southwest point of the North, and the west point of the South Banjaard Bank, is about 21 to 22 feet in the central part of the channel on a ridge about 1,350 yards across; inside this the water is deep and the ground soft in the channel.

The channel is not buoyed.

The Hammen, with not less than 6 fathoms, is the narrow continuation eastward of the West Gat, and lies along the south coast of Schouwen, between that island and the Neeltje Jans, Roggenplaat, and the Roggenstaart, which latter bank contracts the channel to a width of about 400 yards. A junction with the main channel to Zierikzee is formed off the southeast point of the Roggenplaat.

Buoys.—The Hammen is marked by five black can buoys and eight red nun buoys, the latter on the south and west sides, moored on the Roggenstaart and the northeast and east edges of the Roggenplaat. They are numbered consecutively from the westward.

No. 1 black can buoy lies on the north side of the channel in the bight of Schelphoek, and Nos. 3, 4, and 5 on the west side of the Nunnenplaatje.

Veergat is the channel leading southward from the Roompot between Walcheren and North Beveland. At 6½ miles within the entrance the railway embankment across the Sloe cuts off communication with the West Schelde. On the east side of the gat are the Onrust, Schotsman, and Ruiterplaat, banks which dry at low water. In mid-channel is the Haringvreter Shoal, which dries in places and has a channel on each side of it. In general the edges of the banks are steep and the channels are narrow and winding. A large bank named the Goudplaat extends about a mile from the southwest point of North Beveland at the junction of Veergat with the Zuidvliet. The latter channel separates North from South Beveland, its eastern portion being named the Zandkreek.

The town of Veere, on the east side of Walcheren Island, is situated 3 miles within the entrance of Veergat, and was in former times a considerable commercial port, but is now of little importance. The Walcheren Canal enters the gat on the south side of the town. The church with its square tower and dome-shaped roof, together with the spire of the town hall, are visible from the Roompot. Kampveer round tower is only visible from abreast the entrance to the gat.

Buoyage.—Veergat, including the channels on each side of the Haringvreter Shoal, is well buoyed on the uniform system. No. 1 red conical and No. 2 black can buoys lie on the bar, in the approach to which off the western extremity of the Onrust Bank is moored a red and black horizontally striped gas buoy. No. 1, showing an occulting white light—light 7 seconds, eclipse 3 seconds—and is a port-hand buoy on entering. The north end of the Haringvreter is marked by a spherical red and black horizontally striped buoy with staff and diamond.

The dredged channel southward of the mouth of the Walcheren Canal, together with the Zuidvleit and Zandkreek, are also buoyed.

Veere Lights.—At Kampveer Tower is a fixed white light, with a red sector, visible in the Roompot when abreast and to the eastward of Veergat. (See Light List and chart.) It is elevated 38 feet and the white light is visible 10 miles, and the red light 5 miles.

Moleheads.—Fixed green lights, visible 4 miles, mark the extremities of the moles on either side of the entrance to the Walcheren Canal. They are not lighted when the harbor is inaccessible. A fixed green light is also shown from the north molehead of the old harbor.

Wulpenburg Light, on the dyke south of old Middelburg Harbor, is fixed white and red exhibited at an elevation of 33 feet above high water.

Kleverskerke Light.—A small fixed white light, visible 2 miles, is shown from the east side of the Walcheren Canal at Kleverskerke, 1.8 miles from the Veere entrance. (See Light List.)

Anchorage.—There is good anchorage in Veergat abreast Vrouwenpolder Mill, on the flat northward of Haringvreter Bank, but with northerly winds it is advisable to pass west of the bank and anchor off Veere.

Directions.—To enter Veergat requires local knowledge. Pass westward of the red and black horizontally striped light buoy, with occulting white light, and cross the bar, on which the depth is 12 feet at low water. The course of the vessel must be directed by the buoys, red to the westward and black to the eastward, and by the shore of Walcheren. The channel divides at the north end of the Haringvreter Bank; that to the eastward of the bank has a long bar on which, it is stated, there is only 4 feet at low water. The channel westward of the bank is deep until near Veere, off which place small vessels approach the mouth of the Walcheren Canal through a narrow channel in which the least depth is 7½ feet. The dredged channel south of the canal mouth has 7 feet of water in it. The channels on either side of the Haringvreter unite again at the south end of that shoal.

The Zuidvliet and Zandkreek, which separate North from South Beveland, are narrow and winding, and have depths of 16 to 39 feet, except on two bars, the western of which, southeastward of Goudplaat, has about 10 feet least water; the other, situated 4½ miles eastward, has about 9½ feet. The eastern outlet of Zandkreek has about 11 feet of water in mid-channel.

Directions for the East Schelde through the Roompot.—The approach to the Roompot is from the Steen Deep, the directions for which have been given.

From Steen Deep, Veere Church, 119°, leads southward of South Banjaard Buoy and up the entrance between the Banjaard and Kueerens Banks, between No. 1 buoys, over soft bottom, while that over the banks is hard sand.

Middelburg Spire, midway between the easternmost villa at Domburg and Oostkapelle, 151°, also leads up to the buoys.

From midway between these buoys, steer to pass southward of Nos. 2 and 3 black buoys, thence as required for Veergat or up the East Schelde between the red buoys on the starboard hand and black buoys on the port hand, should necessity require it; but though the water is deep it is advisable to take a pilot, as in consequence of the frequent changes in the sands the buoyage as charted can not be implicitly relied on.

Vessels of moderate or deep draft should keep over toward Nos. 4, 5, and 6 can buoys to avoid the Schaar, east side of Veergat; as the depth in the fairway has decreased considerably, being 17 feet at low water, this locality, named the bar of the Roompot, must be navigated with caution, care being taken not to borrow on the southern side of the channel.

Having passed the bar of the Roompot, steer 102° past No. 8 can buoy with staff and truncated cone, when, if bound to Zierikzee, keep more to the northward along the black buoys and bring Brouwershaven in line with Flaauwers Mill 37°, which mark leads along the west side of the Vuilbaard. When Zierikzee Church bears 82° steer toward it until West Schouwen Lighthouse is in line with the tower of Burgh 305°; then steer southeastward to Zierikzee Road, keeping the latter mark open to the northward.

Zierikzee Church bearing 57° leads between the North and South Vuilbaard Banks.

Anchorage.—There is no good anchorage in the Roompot. If necessary, and in fine weather, vessels may anchor in the channel westward of the Middelplaat, or northward of No. 9 black can buoy, but the only safe anchorage is in Veergat.

West Gat and Hammen.—The West Gat should not be navigated without good local knowledge, as the channel is not buoyed and there are no range marks; entire dependence must be placed on the use of the lead. From a position off the South Banjaard Buoy steer about 144° toward Middelburg Spire until West Schouwen Lighthouse bears 65°, when alter course toward it and cross the bar of the West Gat in about 21 to 22 feet of water. When on the above course the depth increases to 5 fathoms at low water steer 79° to pass between the Noordland and the Zee Hondenplaat. The lead gives warning of approach to the North and South Banjaard Banks until Veere Church is well open eastward of Ten Haak Point; after that the banks become steeper, particularly the south edge of the Zee Hondenplaat. From abreast the latter steer more southerly to open the Flaauwers Mill of the southwest point of Schouwen Island Dyke, when steer eastward past the Krabben Plaatje and along the south coast of the island.

At night the line of obscuration of the Burgsluis (fixed white) Light 81° 30′ cuts a little inside the north extremity of the Noordland, south side of the gat.

The Hammen lies along the dyke of Schouwen and is deep. The sides of the channel are steep except westward of Burgsluis; at the west end of the Roggenstaart, and off Schelphoek, where there is a harbor for small craft. Steer to the eastward, guided by the dyke, and pass northward of the first red buoy off Koudekerke; thence follow the buoyed channel to Zierikzee, passing westward of the Nunnenplaatje.

Zierikzee Road, situated on the north bank, some 13 miles above the Roompot, the main entrance to the East Schelde, affords anchorage in its southern portion in depths of 10 fathoms. Nearer the town the depths vary from 9 to 22 fathoms. The average breadth of the channel from the Roompot is upward of ½ mile, with depths varying from about 3 to 18 fathoms, and therefore would not be difficult to navigate were it not for the constant changes above referred to.

Town.—Zierikzee is a small town, connected with the road by a harbor or canal about 1½ miles long in a 228° and opposite direction, with a depth at low water of nearly 5 feet. The heads of the harbor moles are marked by beacons with square screens, and about 440 yards eastward of the harbor, on the Plaatdijk, is a beacon with ball on top, 11½ feet above high water.

Besides the church already mentioned other prominent objects are the town-hall tower and various mills.

Val, a small tidal harbor, lies close eastward of Zierikzee.

Storm signals are shown at Zierikzee, at Ten Haak, near the entrance of Veergat; at Kolynsplaat, at the northeast part of North Beveland; at Burgsluis, north side of entrance to the Hammen; and at Wemeldinge.

Lifeboat.—There is a lifeboat station at Burgsluis, 6 miles westward of Zierikzee, near the southwest end of Schouwen Island.

Keeten and Mastgat Channel to the Maas.—From Zierikzee Road, a deep buoyed channel, the parts of which are named the Keeten, Mastgat, and Zype, with a least width of ¼ mile at low water, trends eastward and northeastward for 10 miles between Schouwen and Tholen Islands, and joins the Maas at Bruinisse; the channel depth eastward of Bruinisse where it enters the Maas is charted as 23 feet at low water springs.

Keeten Channel—Light buoy.—The red and black horizontally striped buoy No. 2 marking the south side of the western entrance to this channel, exhibits an occulting white light every 10 seconds.

The East Schelde—Bergen op Zoom.—The East Schelde from Zierikzee Road trends to the southeastward of Tholen, and, between the dykes of Tholen and North Beveland, is 3.3 miles wide, the width contracting to 1½ miles at Gorishoek, 5 miles farther up. It then expands into a basin 9½ miles long northwest and southeast and 5 miles broad, nearly the whole of which is taken up by shallows and extensive banks, dry at low water, to the southwestern and southeastern parts of which the name of Verdronken Land is given.

Depths.—At the northeast part of this shallow basin, the town of Bergen op Zoom is situated. The water is deep to within 5 miles of it, but nearer to the town the depths are 17 feet, gradually decreasing to about 10 feet off the town.

The part of the river between Tholen and North Beveland is to a great extent occupied by banks, dry at low water, named the Galgeplaat, Vondelings Plaat, Dortsman, and Middelplaat.

Engelsche Channel is the western and the principal passage leading from Zierikzee Road up the East Schelde; it lies between the Vuilbaard Bank and North Beveland on the west, and the Galgeplaat on the east. The north part of the channel is narrow and the tidal current is strong; the least depth i nmid-channel south of the Vuilbaard is about 3½ fathoms; it here unites with the Schaar van Kolynsplaat and hence eastward to Wemeldinge is deep. Near Wemeldinge is the entrance to the South Beveland Canal, which connects the East with the West Schelde a Hansweert.

The channel is buoyed on the uniform system; red to starboard, and black to port when proceeding inward; a red and black horizontally striped light buoy, showing an occulting white light, lies on the south extreme of the South Vuilbaard at the junction with the Schaar van Kolynsplaat; a similar buoy also showing an occulting white light lies at the entrance of Zandkreek about 3.8 miles westward of the canal.

The other channels from Zierikzee to Wemeldinge are the Brabantsche, on the east side of Vondelings Plaat, with a least depth of 12 feet; the Vlije, a continuation southward of the Brabantsche is narrow, with 11½ feet least water; and the Dortsman, a narrow channel between the Middelplaat and the Dortsman Bank. These channels are also buoyed on the uniform system.

Above Wemeldinge the channel becomes narrower and divides into a number of creeks, one of which lies along the southeast side of Tholen and forms the Eendragt eastward of that island, and the Bergsche Deep leading to Bergen op Zoom, both only fit for small vessels. The other creeks lead southward between the various banks and lose themselves in the Verdronken Land.

Lights.—For lights above Zierikzee, see Light List.

Storm signals are shown at Goesche Sas, about 1 mile southeastward of the entrance to Zandkreek.

Wreck.—The iron vessel Cornelia lies sunk 880 yards off Wemeldinge Harbor, and is marked by a green nun and a green can buoy, and is lighted at night.

Maas River, or Meuse, flows through part of Belgium and Holland, is joined by branches of the Rhine. It empties into the North Sea by three mouths, between Schouwen, Goeree, Voorne, and the Hook of Holland, namely, the Brouwershaven, Goeree, and Noorder Gats, and the Brielle Gat. The New Waterway or Rotterdam Canal is an artificial cut through the Hook of Holland, the direct channel to Rotterdam. These all communicate with one another by minor channels or canals, and have upon their banks the towns of Brouwershaven, Hellevoetsluis, Willemstad, Dordrecht, Rotterdam, etc.

The navigable depths in the several gats or channels leading from seaward to the harbors or roadsteads are mentioned with the description of the gats.

Pilots.—The Brouwershaven pilots cruise off Dungeness in a schooner and off Brouwershaven and Goeree Gats in a black yawl at from 4 to 8 miles seaward of the outer buoyage and within the limits of West Schouwen Lighthouse bearing 144° and Goeree Lighthouse 110°. They have the names "Goeree," "Maas," and "Brouwershaven," together with the number of the vessel, painted in large letters on the mainsail. As long as the vessels are able to furnish pilots they show at the masthead a blue flag with their number and also the Dutch pennant from the gaff end. At night they carry a white light and show a flare-up every 15 minutes. In the event of a pilot vessel not being fallen in with, the lifeboats are generally on the lookout to supply qualified persons or to render assistance.

Brouwershaven Gat.—The town of Brouwershaven, at the eastern part of the north side of Schouwen, gives its name to the gat or main navigable channel between the islands Schouwen and Goeree, the southernmost of the three main passages into Maas River. The roadstead off the town affords anchorage for all classes of vessels.

Aspect.—The general appearance of the seaward and southern parts of Schouwen Island, its white sand hills, the Woolpacks at the west end, various church towers and mills, and the prominent character of Zierikzee Church have been already mentioned.

Off the north coast of Schouwen the towers of Renesse, with a mill to the westward, of Noordwelle, of Elkerzee, with a mill to the northward, and the cupola of East Repard are prominent; also the church and town-hall tower of Brouwershaven are visible here. The ridge of dunes eastward of the Verklikker of West Schouwen is very narrow, and the shore from Laagte to East Repard is defended by groins. At the latter place the dunes end and the dyke begins.

Goeree Island, on the opposite side and 11 miles from the entrance to the gat, when viewed from a distance appears as detached white hummocks, those at the western end being the highest. The southwest end of the island consists of a rounding sandy point named the Springer, whence the south shore trends eastward for 5 miles, and then turns sharply to the southward for 6 miles, being embanked for the whole distance and fronted eastward of Oosternol by a broad mud flat named the Slikken van Flakkee.

Depths—Bar.—The gat has on its south side the North Banjaard and the shore of Schouwen and on the north side the Ooster Zand; its entrance is about ¾ mile wide, from a low water depth of 4 fathoms on each side and 5 to 6 fathoms in the fairway to abreast the west end of Schouwen.

A bar about 3 miles in length, within a depth of 5 fathoms, extends westward from abreast North Schouwen Lights, and connects with the banks northward of it. The shallowest part of the channel across it, 14¾ feet at low water springs, is between Nos. 6 and 7 buoys and is known as the Schaar Renesse; the approach to it has a depth of 5 to 6 fathoms, with deeper water within the bar. Springs rise about 9 feet. Vessels of 26 feet draft have crossed the bar and anchored in the western part of Brouwershaven Road.

The least depth in the ship channel between the sea and Dordrecht, a distance of 50 miles, entering by the Brouwershaven Gat, is 10½ feet at low water and 20½ feet at high water springs, in the West Hellegat, westward of Willemstad, but is subject to constant change.

Sand banks.—**The Bollen van Goeree and Buiten,** lying about 8 miles offshore, with general depths of 6 to 9 fathoms, and patches of 4½ to 5 fathoms in places, front the mouths of the Maas; the chart will afford better information than a written description. A wreck is charted on the southwest end of the former bank.

Ooster Zand extends 10 miles westward from Goeree Island, and separates Brouwershaven Gat from Goeree Gat. Ooster Zand includes the Middelplaat, the Kabbelaars Bank, and the Aardappelenbult, which dry, and the Jong Springer.

Its northwestern or seaward edge has some patches with from 4 to 7 feet of water, the outermost of which is named the Stiele Hoek. Along this edge of the sand the ground is soft and in places steep-to, so that is can not be approached at night by the lead with safety.

The flat of less than 4 fathoms of water with some patches of 17 feet, lying westward of the Middelplaat, is named the Rug van den Ooster; it forms the north side of Brouwershaven Gat.

Some patches with from 27 to 30 feet outlie the west end of Ooster Zand and the Banjaard, the positions of which will be best understood by referring to the chart.

Buoy.—A black and white vertically striped conical buoy with staff and triangle, marked "Ooster," lies in about 8 fathoms, about 2 miles westward of Steile Hoek, northwest side of Ooster Zand.

Hompelvoet and Paarden Plaat form one shallow triangular-shaped bank, the greater part of which is bare at low water. They separate Brouwershaven Road from the Springer Deep.

Dwars in den Weg is a bank for the most part dry at low water, fronting the bight in which is Brouwershaven Harbor; from its east end, a bank which dries in places curves northward and westward on the north side of Brouwershaven Road. There is a narrow and buoyed channel between Dwars in den Weg and the shore, with only a depth of 4 feet at its eastern end. The whole bank is surrounded by buoys.

Springer Deep and Hals.—The western part of the Springer Deep lies between the south shore of Goeree and the Hompelvoet Bank, and farther to the eastward between the Slikken van Flakkee and the Paarden and Veermans Plaats it continues under the name of Hals Fairway and joins the Grevelingen Channel at the southeast extremity of Vermans Plaat.

The least depth on the bar at the southern end of the Hals is 9 feet at low water.

Buoys.—Springer Deep and Hals are marked on the east side by three black can buoys, and on the west side by six red nun buoys, one spherical red and black striped buoy with upright cross topmark, and one red light buoy marked "Hals," which shows an occulting white light every 10 seconds. The striped buoy is moored off the east end of the Paarden Plaat at the junction of the Vlieger Channel and Springer Deep, and the light buoy lies off the east side of the Veermans Plaat toward its southern end.

Lights.—The chief objects which serve to distinguish Schouwen from the islands near it are the several lighthouses and beacons standing on the northern parts of the island, for the purpose of distinguishing the coast, and for range marks through Brouwershaven Gat.

West Schouwen Lighthouse (lat. 51° 43′ N., long. 3° 41′ E.), the principal of these, is a circular stone tower with black gallery, standing on one of the sandhills at the northwestern extremity of the island, near the Hook of Schouwen. It exhibits at 185 feet above high water a group flashing white light, visible 19 miles. (See Light List.)

Telegraph.—West Schouwen Lighthouse is connected with the telegraph system and signals may be made by the International Code.

Storm signals are shown at West Schouwen Lighthouse.

Verklikker Light is fixed, with white and red sectors, exhibited, at a height of 62 feet, from a lantern on a dwelling on the northwest part of Schouwen Island, 1 mile northeastward of Schouwen Lighthouse.

Storm signals are shown near Verklikker Light.

Laagte van Haamstede Light is fixed white, exhibited, at a height of 44 feet, from a white lighthouse on a black square iron framework.

North Schouwen Range Lights.—The front light is occulting white, exhibited at a height of 77 feet. The rear light is fixed, with white and red sectors, exhibited at a height of 125 feet. Both lights are exhibited from gray lighthouses on dark red frameworks, 93°, 645 yards apart, the white lights being visible 12 miles and the red lights 8 miles.

Ossenhoek Light is fixed white, shown from Ossenhoek on the end of Lange Dyke, west side of entrance to Brouwershaven, and is exhibited from a brown wooden lighthouse on piles at a height of 25 feet.

Oosternol Light.—From a brown post on the west molehead at Oosternol, the harbor of Ouddorp, south side of Goeree Island, is exhibited, at a height of 19 feet above high water, a fixed white light, visible 3 miles. It is shown from October 1 to March 31.

Lifeboat—Storm signals.—A lifeboat is stationed at Oosternol. Storm signals are shown.

Buoyage of Brouwershaven Gat. A beacon, with square topmark, named the Scherm, is established on the shore northwest of West Schouwen Lighthouse; the two in line 121°, form the range mark for approaching Brouwershaven Gat.

A fairway buoy, model hourglass, red and black vertically striped, marked "Brh. Gat." and surmounted by the Netherlands flag, is moored in about 6 fathoms, with West Schouwen Lighthouse bearing 115°, distant 5½ miles.

South side of gat: The outer red buoy, nun, No. 1, is surmounted by a ball, and lies a little more than a mile southeast of the fairway buoy; eastward of it Nos. 2 to 5 are moored at varying distances apart, and all mark the north and northeast edge of the North Banjaard Bank; the last buoy, No. 5, is moored off the Laagte van Haamstede, on the line of the Verklikker and West Schouwen Lighthouse in one, 209°. No. 6 with staff and ball lies westward and No. 7 eastward of the Schaar Renesse. No. 8, spherical, red and black horizontally striped, with staff and diamond, lies on the northwest extremity of Dwars in den Weg Bank, and Nos. 9, red with staff and ball, 10, 11, and 12 mark the north edge of the northern grounds of that shoal.

North side of gat: The outer black buoy, can, No. 1, is surmounted by a truncated cone. It lies about a mile eastward of the fairway buoy and about ¾ mile north-northeastward from No. 1 red buoy; Nos. 2 to 5 can buoys lie on the south side of the Ooster and Rug van den Ooster; No. 6 on the western, and No. 7 with a truncated cone on the eastern side of the Schaar Renesse; Nos. 8, 9, and 10, the last with truncated cone, lie on the south side of the Middelplaat; No. 11 off the bar between the latter shoal and the Hompelvoet, the south side of which is marked by Nos. 12 to 15; No. 13 has a truncated cone as top mark.

The numbers of the buoys are consecutive on either side and there is no difficulty in approaching and entering Brouwershaven Road by them.

Brouwershaven Road is marked on the south side by two green nun wreck buoys, and one red nun buoy with diagonal cross, and on the north side by two black can buoys, each with an upright cross. These buoys are not numbered.

A beacon with ball on top stands at the end of a stone jetty at Ossenhoek.

Above the road the buoyage may not be so reliable, and navigation should not be attempted without a pilot.

The Steen and Banjaard Bank buoys in the southern approach to the entrance have been before mentioned.

The passage westward and southward of Dyars in den Weg, that leads from the inner road to the Grevelingen, is marked by 7 black can buoys, Nos. 1 to 3 lying on the west side of the bank, and Nos. 4, with truncated cone, 5, 6, and 7 on the south side. A red nun buoy lies on the south side of the channel abreast No. 4 can buoy. At the eastern part of the passage is the narrow and shallow channel of Bommenede, marked by buoys.

Tides and tidal currents at Brouwershaven.—The high-water interval at Brouwershaven is 1 h. 58 m.; springs rise about 9 feet, much affected by the strength and direction of the wind. The flood current (south and easterly) runs about six and one-half hours.

Some distance outside Brouwershaven Gat, the currents have the same rotary motion as those of the gats or channels of the West Schelde, as before described. Outside and near the outer buoy of the gat, the tide begins to rise at about six hours after high water at Brouwershaven, when the direction is about southwest; for the next three hours of the flood it sets toward and over the Banjaard Banks; and afterwards into the river until high water. Then the ebb begins, first setting northward and working round to west, until at the fourth hour it is setting about west, thence to low water it sets fairly out of the gat. The third hour of the rise coincides nearly with high water at Dover. In Brouwershaven Road, and northward of it, also in Springer Deep, both flood and ebb set regularly up and down the channels; the currents turn shortly after high and low water, and attain their greatest strength at about half tide. In the Vlieger Channel a good flood current runs, but the ebb is weak; in the Hals the reverse is the case.

Directions—Anchorage.—Brouwershaven Gat, from its depth and general character, is one of the safest ports on the coast of Holland for vessels of deep draft; and being well lighted it may be entered by night as far as No. 5 red buoy. The frequent changes in the banks and buoys, however, render the aid of a pilot advisable. The low water depth in the channel over the shallowest part is about 14¾ feet, between Nos. 6 and 7 buoys on either side.

Those in the offing approaching Brouwershaven Gat will, if the weather be clear, sight Middleburg Spire, Westapelle Light Tower, and the other objects in Walcheren, and then the lighthouse of West Schouwen; the latter should be kept between 121° and 99° by those lying-to in the offing, and they should attend to the lead and not shoal the water under 10 fathoms.

Approaching the gat from the northward, to pass northeastward of Schouwen Bank in about 7 fathoms, do not bring West Schouwen Lighthouse to the eastward of 133° until Schouwen Bank Light Vessel bears westward of 211°; then Schouwen Lighthouse and Scherm Beacon may be brought in line, bearing 121°, which leads eastward of Middel Bank in 11 and 12 fathoms, and up to and between the distinguishing or fairway buoy at the entrance of the gat and No. 1 black can buoy, very near the latter, which buoy marks the southwest extremity of Ooster Bank.

Middelburg and Oostkapelle spires in line, bearing 149°, lead over Schouwen and Middel Banks, in not less than 5 fathoms until within

2 miles of Noord Steen Bank buoy, when course may be altered for the distinguishing buoy of Brouwershaven Gat.

In hazy weather a vessel may cross the Schouwen Bank at about ½ mile southward of the southernmost watch buoy of the light vessel, in 5 fathoms of water; there is a 22-foot patch at about 140 yards 290° of the buoy. It is not advisable to go nearer the Banjaard Sands in a vessel above moderate draft than the depth of 10 fathoms, as they are steep-to, until the North Schouwen lighthouses are in line, bearing 93°, which being steered for will lead to the distinguishing buoy of the gat, and through the fairway as far as No. 4 red buoy.

The lower of the two lighthouses may be seen from 5 miles outside the gatway. It should be borne in mind that the first three hours of the flood sets obliquely toward the Banjaard, and the first two hours of the ebb sets toward Ooster Zand. The direction, as well as the strength of the current, is, however, influenced by the wind.

Proceeding toward Brouwershaven, from near No. 4 red buoy, the track is continued between red nun buoys on the starboard hand and black can buoys on the port hand. These are numbered consecutively, and the channel presents no difficulty, provided the buoys are correctly placed. The wreck of the *Elizabeth*, marked by a green buoy, lies on the south side of the fairway between Nos. 4 and 5 red buoys. The north side should be kept until past her; then Nos. 6 and 7 buoys should be passed, keeping about mid-channel, which gives the best water over the Schaar, namely, 14 feet; within the water deepens.

Turning through.—To work into Brouwershaven Gat with safety, a general acquaintance with the objects, as well as with the set of the tidal currents, are necessary. As there is a leewardly set in strong northeasterly winds, the gat should not then be attempted. There is scarcely a landmark by which a vessel's approach to the banks on either side may be known; therefore the buoys and a strict attention to the lead are the only guides to a stranger, who is recommended to employ the services of a pilot.

The western part of Ooster Zand is too steep to be closed by the lead, and the south side of the gat is also steep along the Nieuwe Sand between the second and fourth red buoys. It is therefore necessary, in either case, to tack before the line of the respective buoys be reached. Above the fourth red buoy and at the anchorage previously referred to the south shore is shelving, but it is advisable not to approach either side of the gat into a less depth than 4 fathoms.

At night, having crossed the Schouwen Bank at about 2½ miles north or 1 mile south of the light vessel (unless of light draft), the light vessel kept astern, bearing 299°, or West Schouwen flashing light ahead, 119°, will lead to the distinguishing buoy at the entrance of the gat; here Goeree flashing light will become obscured when bearing 77°, but will be sighted again about 3.8 miles to the eastward on a 70° bearing, when approaching No. 4 buoys. When North Schouwen range lights are in line, bearing 93°, steer for them. The Verklikker Light on the Hook of Schouwen first appears on a 153° 30′ bearing and serves as a caution to haul to the north side of the line of the range lights to avoid the wreck of the *Elizabeth.* The anchor should be let go when West Schouwen Light appears over the Verklikker, 209° 30′, and North Schouwen lights open as above. In the position thus indicated there is a low water depth of 3¾ fathoms, and though it is not a safe anchorage at all times it has the advantage of having a flat and partly sheltered strand closely adjoining in case of accident. Vessels must not proceed within this without local knowledge; but if it is necessary to do so, steer eastward with the North Schouwen lights in line until almost abreast No. 5 red nun buoy, when the West Schouwen Light will be in line with the Verklikker Light, 209° 30′, then alter course 5½° to the eastward and bring the West Schouwen Light in line with the fixed white light at Laagte van Haamstede, which will lead over the Schaar, but apparently southward of No. 6 red nun buoy. On this course a vessel will be past the Schaar when the western North Schouwen Light is obscured, and the red sector of the eastern light is sighted, which should occur simultaneously. Then steer a general 96° course toward Ossenhoek fixed white light, passing close northward of No. 7 red buoy and southward of No. 10 black buoy. A vessel will have passed No. 7 when the North Schouwen red light is obscured, and the white sector of the same light being sighted bearing 222° 30′ gives notice of approach to No. 10. The light at Ossenhoek should not be approached too closely on account of a long stone jetty with a beacon on the end, which projects northward. Goeree fixed light is visible in the western part of Brouwershaven Road, but is obscured when bearing northward of 29° 30′.

Brouwershaven Road.—Brouwershaven Road lies northward of the town and of the Dwars in den Weg Bank. It is frequented by vessels bound to Dordrecht and Hellevoetsluis; here they discharge a portion of their cargoes and are then towed to their place of destination. The road is about 600 yards wide, has the advantage of good holding ground, with depths of 5 to 10 fathoms and more, the deepest water being in the western part and shoaling gradually eastward, and being well protected by sand banks the sea is only felt during strong westerly winds. The inner road lies between Dwars in den Weg and the entrance to the harbor.

There is fairly good anchorage in the road, in 26 feet, between the black can buoys with upright crosses, with apparently deeper water farther westward. Vessels lying here are not sheltered from strong westerly winds, which cause a good deal of sea in this gat.

There is a low water depth of 11 feet on the bar leading to the inner road between Ossenhoek and No. 8 buoy, a red and black horizontally striped buoy with diamond topmark; the west side of the channel is marked by poles and the east side by black buoys, both being steep-to; there is good anchorage in the inner road in 5 fathoms, with Brouwershaven Church in line with the mill; vessels should not anchor eastward of the harbor entrance on account of several deep holes in which the anchor does not hold. An old submerged stone jetty projects from the south shore and is marked by No. 1 red nun buoy.

During westerly gales vessels at times run through the Vlieger and anchor under Paarden Plaat in charge of a pilot. The Vlieger has a least depth of 18 feet in the fairway.

Brouwershaven town is ancient, and its fortifications have been removed. It has decreased greatly in importance since the Hook of Holland route came into use.

The harbor is dry at low water, and only fit for small vessels.

Coal.—About 200 tons of coal are kept in stock.

Lifeboat—Telegraph.—There is a lifeboat stationed at Brouwershaven, and there is a telegraph station. Storm signals are shown here.

River above Brouwershaven.—The channels leading up the river from Brouwershaven to Bruinisse, Willemstad, and Dordrecht will now be briefly traced.

Vlieger.—This channel lies between the Paarden Plaat and Kabeljauws Plaat, and connects the inner end of Brouwershaven Gat with Springer Deep and Hals; the sides of the channel are steep; of late years it has shoaled considerably.

Grevelingen Channel is the name of the fairway from the Vlieger to Bruinisse, a distance of about 9 miles, where it connects with the Schelde.

The channel runs between the west side of Kabeljauws and Veermans Plaats, and the shores of Schouwen and Duiveland, and is buoyed on the uniform system.

There is a storm signal station at Bruinisse.

There is a depth of 20 feet at the south end of this channel.

From Bruinisse the ship channel takes a winding course eastward for a distance of about 17 miles to Willemstad, passing between the island of Overflakkee on the north, and the shores of Philipland and North Brabant on the south. The various parts of the channel are distinguished by the following names, commencing from Bruinisse: Krammer, the western part of which is named Bocht van St. Jacob, marked by buoys; Noorder Gat, marked by three light buoys; Volkerak; Karolinageul, marked by four light buoys, with a least depth of 16 feet at its western end; West Hellegat, marked by light buoys, has about 8 to 9 feet at low water, and is subject to constant change. The West Hellegat runs northward and joins the west end of Hollandsch Deep about 2 miles below Willemstad; the East Hellegat is also buoyed, and has a least depth of 10 feet. Two telegraph cables are laid across the south part of the two Hellegats, from Fort De Ruiter near Willemstad, to Fort Prins Frederick near Ooltgensplaat on the western bank.

East and West Hellegat—Prohibited anchorages.—Anchorage is forbidden in East and West Hellegat, and on the shoals and banks in the area bounded northward by the line connecting can buoy No. 3, West Hellegat, and nun buoy No. 4, East Hellegat, and southward by the line connecting can buoy No. 2, West Hellegat, and can buoy No. 1, East Hellegat.

Masters who, in conflict with the above order, have anchored their ships within the prohibited area are obliged, on the first notice thereof given in the name of the military authority, immediately to shift their anchorage.

Ships whereof the masters are not immediately obedient to the notification, as above, or which by night without lights within the water area of the post are found, shall be taken to Willemstad for further examination without any right to indemnification for damages.

Buoys.—A mooring buoy painted black and white in checkers and provided with a lantern showing a fixed white light is located in the middle of the West Hellegat opposite the entrance to Ooltgensplaat.

A light buoy, painted in red and black vertical stripes, marked "H.G.-H.D.," and showing a white occulting light every ten seconds, is moored at the junction of East Hellegat and Hollandsch Deep.

Dintelsas Refuge Harbor, in the Maas below Willemstad, is open for shipping. The entrance is indicated by two fixed green lights, one on the end of each harbor mole.

The town of Willemstad in North Brabant is situated at the west end of Hollandsch Deep, 14 miles above Hellevoetsluis, on the south bank of that branch of the Maas which has its outlet at Goeree Gat. An electric cable crosses the river from Willemstad to the north shore. Its position is indicated by notice boards on the banks; vessels must not anchor near it.

The channel from Willemstad trends eastward through Hollandsch Deep between Beierland and North Brabant for a distance of about 7 miles to the entrance of Dordsche Kil, through which and the Mallegat, together 5 miles in length in a north-northeasterly direction, a vessel passes into the Oude Maas, ½ mile below Dordrecht.

A light buoy is moored at the eastern end of Hollandsch Deep, in the approach to the Kil, replaced in winter by a red spar buoy.

The least depth in the Kil is 16½ feet at low water; on the bar at its south entrance a depth of 16 feet is maintained by dredging. The depth of the Oude Maas near and below the entrance to the Kil is about 8½ feet.

All the above channels are well buoyed on the uniform system, in addition to the light buoys mentioned, which show occulting lights every 10 seconds. Constant changes occur in the channels, and the buoys are altered accordingly, for which reason the charts may not always show them correctly.

Dordrecht, on the Oude Maas, about 40 miles above Brouwershaven and 14 miles above Willemstad, has a population of 48,295. The town has a considerable amount of trade.

The quay has about 16 or 17 feet of water alongside at low tide. (For depths in the approach, see the Kil, above.)

Coal.—About 2,600 tons of coal are kept in stock at Dordrecht.

Storm signals are shown at Dordrecht, and at Willemsdorp, south entrance of the Kil.

Lights.—For lights above Brouwershaven, see Light List.

Tides.—At Willemstad the tide rises for five and a quarter hours and falls for seven and a quarter hours, springs rise 9 feet; at Willemsdorp the corresponding times are five hours and seven and one-half hours.

In the Krammer, the tidal currents turn at about two hours after high and low water.

Goeree Island—Aspect.—Goeree Island, which was formerly a distinct island, is connected with the larger island Overflakkee, and together they are about 20 miles in length; it is generally low, with comparatively high sand hills toward its western end and along the northern face; those at the western end are named Westhoofd, and among them are some high dunes named the Five Hompels (humps). The church of Goedereede is a very conspicuous landmark; other objects are the lighthouses at Flaauwe Werk and Yzeren, the dome-shaped church tower of Ouddorp, visible between the dunes, with two mills near it; the small church turret of Stellendam, southeastward of Goedereede, with a high mill near it.

At Flaauwe Werk and from Yzeren Baak to beyond Stellendam the coast is protected by groins, those westward of Goedereede Harbor being mostly buried under the sand, while those to the eastward are beaconed. Eastward of Goedereede Harbor the land is dyked.

Voorne Island—Aspect.—Voorne, like Goeree, has sand hills on its seaward side, those on the western end being named Bosduin, and are of no great height. On the northeast side of the island is Brielle, a fortified town, the large square tower of the church of which, like that on Goeree, is visible in clear weather from a considerable distance. Off the entrance of the Noorder Gat the turret of Oost Voorne, with a pear-shaped top, situated about ½ mile inland, shows over the trees on the northwest side of the island. The pointed turret of Rokkanje, on the western part, nearly a mile inland, may be seen between and over the dunes. Kwak Point, 1 mile northwestward of Hellevoetsluis, and the small wood near it are readily recognized, and the chimney of the waterworks to the northwest of the point is generally visible.

Goeree Gat—Depths to Hellevoetsluis.—The middle of the three outlets of the Maas, that running between the islands Goeree and Voorne, is known by the name of Goeree Gat. It again has three entrances—namely, the Slijk Gat, the southernmost, with a low-water depth of about 16½ feet on its bar with the range lights in line. On the nun buoy side the water is 2 feet deeper; the Bokke Gat, close northward of it, has about 13 feet; and the Noorder or Nieuwe Gat has from 10 to 12 feet; the rise of tide is about 7¼ feet at the entrance and 5½ feet at Hellevoetsluis. Within the bars the water is deeper.

The depths for Goeree Gats and Channels are for January, 1909.

The least water between the sea and Dordrecht, a distance of 37 miles above the bar, is 16½ feet at low water and 25 feet at high water springs in the Dordsche Kil, about 3 miles below Dordrecht.

Banks.—**Hinder Bank** occupies nearly the whole of the estuary of the middle mouth of the Maas, known as Goeree Gat, and the channels from the sea toward Hellevoetsluis, below mentioned, are only swashways across it.

The outer or western 5-fathom edge is from 4 to 6 miles westward of Voorne Island, and within the depth of 3 fathoms is fairly steep-to, so that in thick or hazy weather it is not prudent to approach within a depth of 6 fathoms. Patches of 27 to 30 feet outlie the bank.

On the bank the depths vary from ½ to 3 fathoms, and a portion of it dries—namely, the Ribben on the eastern side over a mile in extent. The Bollen, a shoal patch on the northern part of the bank, is stated to be extending northward.

Southward of the Ribben are the Garnalenplaat and Tonneplaat, both of which dry, and in continuation of these, extending up river to beyond Hellevoetsluis, are the Scheelhoek, Slykplaat, and the Meneersche Plaat, all extensive dry banks at low water.

Zee Honden Plaat, West Plaat, and Maas Bank form the continuation northeastward of Hinder Bank, extending about 3½ miles off Voorne Island, and fronting the Hook of Holland.

Buoyage.—The buoyage is in accordance with the Netherlands uniform system, but, though every effort is made to keep the outer buoys correctly charted, implicit reliance must not be placed in them.

The Hinder Buoy is a black and white checkered conical buoy with staff and diamond, moored in 4½ fathoms, ¾ mile northwest of the southwest extremity of the 2-fathom edge of the Hinder Bank.

Hinder Ribben is a white light and whistle buoy, exhibiting an occulting white light every 10 seconds—thus: light 7 seconds, eclipse 3 seconds. It is moored in about 6 fathoms, at about 1.3 miles 285° of the west edge of Bollen Bank, the north part of Hinder Bank.

From the buoy, Monster Church is nearly in line with the light on the end of the north pier of the new Rotterdam Canal.

The Slyk (Slijk) Gat is the best channel from sea to Hellevoetsluis, thence through North Pampus, which has a depth of about 23 feet, subject to frequent change. It trends in an easterly direction for 4½ miles from the inside of the bar, between the Tonneplaat and Garnalen Banks, and the north coast of Goeree, from the latter of which it is distant about 1 mile, a shoal flat intervening. Off Kwade Hoek the channel turns southeastward and, with its continuation the Zuider Deep, which has deeper water, lies close along the north shore of the island, between it and the Scheelhoek Bank and Slykplaat, until near the harbor of Dirksland. The eastern part of the channel and the Aardappelen Gat lie farther from the shore.

Near the Kwade Hoek the direction and depth of the channel frequently change.

Noord Pampus Channel leads from the north part of the Zuider Deep, abreast of Kwade Hoek, into the Rak van Scheelhoek, passing northward of Scheelhoek Bank. It is about 150 yards wide and has a least depth (1915) of 12 feet at low water in mid-channel, and shoaler water toward both sides. It is subject to frequent change. This channel leads direct toward Hellevoetsluis.

South Pampas Channel connects with Zuider Deep and passes southeastward of Scheelhoek Bank. The passage is quite narrow and very short, having a least depth of 8½ feet.

Veermansgeul leads from the eastern part of the Zuider Deep, over the Slykplaat, into the Lens off Hellevoetsluis; the least depth, 1½ feet at low water, is at the southern outlet. The buoys have been removed.

Aardappelen Gat, leading from the Zuider Deep into the Haringvliet, northward of the Meneersche Plaat, has only about 9 feet of water, which is maintained by dredging. Thence to Hellevoetsluis the water is deeper.

Bokke Gat, which has 13 feet on its bar at low water, as already mentioned, curves to the northward and eastward from within the bar of the Slyk Gat, between the Ribben and Garnalen Plaat, and then turns southeastward. The south side of the Ribben is very steep, and a small part of the bank does not cover at ordinary high tide; the Garnalen is less steep. Eastward of the Ribben the channel unites with the Noorder Gat, and together they flow southeastward between Voorne Island and the Scheelhoek, as the Rak van Scheelhoek, with deeper water than on the bar.

Nieuwe or Noorder Gat lies between the Bollen and Ribben on the west, and the West Plaat, Zee Honden Plaat, and the shore of Voorne on the east. The depth on the bar at the northern entrance is 10 to 12 feet, thence to its junction with the Bokke Gat the distance is 4.3 miles with deeper water.

Rak van Scheelhoek is the channel between the Scheelhoek and the coast of Voorne Island, westward of Hellevoetsluis. It has depths of 5 to 6 fathoms. That part of the Scheelhoek northward of the Noord Pampus Channel is extending eastward.

A bank named the Kwak, which nearly dries in places, extends 400 yards from Kwak Point, about 1.3 miles northwestward of Hellevoetsluis.

Goeree Light.—The principal light is that on Goeree on Goedereede Church, which has a massive square tower, forming one of the principal marks used in entering the Slyk Gat. A fixed white light is shown from its summit, 148 feet above high water, visible 14 miles. This light is intensified over an arc of 4° on each side of the range line for Slyk (Slijk) Gat. (See Light List.)

Goedereede Harbor Lights.—Two fixed white lights, visible 2 miles, are shown at Goedereede Harbor entrance during the winter nights only; in line they lead to the entrance of the harbor. A fixed red light is shown from the beacon at the head of the harbor mole.

Telegraph.—The lighthouse is connected with the telegraph system; vessels can communicate by the International Code.

Storm signal.—A station is located on Goedereede Light tower.

Westhoofd Lights.—From a gray octagonal tower, 171 feet in height, situated 2 miles westward of Slyk Gat Lighthouse, is exhibited, at an elevation of 180 feet, a group flashing white light, visible 19 miles. An auxiliary fixed light, with a white and red sector, elevated 108 feet, is shown from the same tower. The white light is visible 14 miles and the red light 10 miles.

Lifeboat.—Yzeren Baak is a lifeboat station.

Slyk Gat to Hellevoetsluis.—Above the Slyk Gat, for the navigation of the Zuider Deep and Aardappelengat and to Hellevoetsluis, lights are shown as described below; they are only available to those locally acquainted.

Slyk Gat Light.—From a brown octagonal tower, 33 feet in height, erected on the coast at about 2½ miles westward of Goeree Light, is exhibited, from an elevation of 59 feet, an occulting white light with a red sector.

This light, in line with Goeree Light, bearing 102°, leads through the deepest channel, over the bar of Slyk Gat.

Molenpolder Light.—On the dyke at Molenpolder, close westward of the entrance to Stellendam Harbor, a fixed white light is exhibited at a height of 28 feet above high water; it is shown from a white lighthouse on a square iron framework.

Stellendam Light.—On the west molehead of Stellendam Harbor is exhibited, at a height of 15 feet above high water, a fixed white light, from a gray lighthouse on a brown hexagonal iron framework.

Scharrezeepolder Light.—On the dyke, ½ mile 105° from Stellendam Church, a fixed white light, elevated 33 feet above high water, is exhibited from a brown lighthouse on square iron framework; the light shows down river.

Middelharnis Lights.—A fixed white light is exhibited at a height of 27 feet above high water, from a yellow iron framework with ladder, situated on the end of the west pier at Middelharnis Harbor.

Two fixed white lights are shown at the sluice gates, 500 yards up the canal.

Middelharnis Range Lights are fixed green, elevated 12 feet, and are exhibited from lamp-posts erected on the east pier; in line they lead to the harbor entrance.

Dirksland Harbor Light is fixed green, elevated 21 feet, and shown on the head of the west pier.

Hornsche Hoofden Light is occulting, with white and red sectors, exhibited, at a height of 30 feet, from a gray lighthouse on a dark red framework on the dyke.

Fog signal.—In thick or foggy weather a bell on the top of the lighthouse at Hornsche Hoofden is sounded in answers to signals from approaching vessels.

Hellevoetsluis Lights—Naval Harbor.—From a circular green stone tower 60 feet high, situated on the west side of the harbor, a fixed white light with red sectors is exhibited at an elevation of 53 feet above high water. (See Light List.)

Fog signal,—In thick or foggy weather a bell is sounded on the east molehead, Hellevoetsluis, in answer to signals from approaching vessels.

Commercial Harbor.—A fixed green light, visible 1 mile, is shown from a lamp-post on each molehead.

Buoyage.—Red conical buoys mark the starboard hand and black can buoys the port hand, on entering, within the fairway buoys.

Slyk Gat.—The fairway buoy is a black and red vertically striped buoy, surmounted by an inverted cone and cross, moored at about 3¾ miles west by northward of Slyk Gat Lighthouse.

The south side of the gat is marked by six red conical buoys, No. 1 being surmounted by a ball, and No. 4 being a light buoy showing an occulting white light every 10 seconds.

The north side of the gat is marked by five black buoys; No. 1 is a can buoy surmounted by a truncated cone; Nos. 2 and 4 are can buoys; No. 3 is a red and black striped spherical buoy, surmounted by a square; and No. 5 is a light buoy showing an occulting red light every 10 seconds.

Off Kwade Hoek the channel is marked by two black can buoys, Nos. 1 and 2, and two red conical buoys, Nos. 2 and 3.

North Pampas Channel is marked on the south side by three red conical buoys. The north side is marked by four black buoys. No. 1, a light buoy, shows a group flashing red light. Nos. 2 and 3 are can buoys. No. 4 is a light buoy, showing an occulting red light every 10 seconds. The center of the western entrance is marked by a red and black horizontally striped buoy, surmounted by a diamond.

South Pampas Channel is marked by No. 1 spherical buoy, painted red and black in horizontal bands, with broom topmark, and No. 1 black can buoy.

Zuider Deep is marked on its northeastern side by black can buoys; Nos. 2 and 7 with staff and truncated cone. Its southwestern side is marked by nun buoys Nos. 1 and 2.

Aardappelen Gat has on its south side four red conical buoys, of which No. 4 is a light buoy, in 21 feet of water, showing a fixed red light. The north side has six buoys. No. 1, red and black horizontally striped, spherical, with staff and cone, also marks the southern entrance of Veermansgeul. Nos. 2 to 5 are black can buoys. No. 6, in 19 feet of water, is a striped buoy, with cone similar to No. 1, and marks the junction of the gat with the Haringvliet, which from here to Hellevoetsluis is marked on the west side by red conical buoys. On the formation of ice, No. 4 light buoy is replaced by a red spar buoy with staff.

Bokke Gat is marked on the south side by six red conical buoys, Nos. 1, 3, and 6 being surmounted by a staff and ball. No. 1 buoy lies about 4½ miles east by northward of the fairway buoy, described in the buoyage of Slyk Gat. The north side of the channel has seven black can buoys; No. 1 lies 4¼ miles east-northeastward of the fairway buoy; No. 2, in 16 feet, and Nos. 4, 5, and 6 lie in 13, 16, and 15 feet of water, respectively, on the southwest and south sides of the Ribben, and No. 7 lies in 18 feet off the southeast end of the Ribben.

A red and black horizontally striped buoy, surmounted by a triangle, marks the eastern entrance.

Nieuwe or Noorder Gat.—The west side of this channel is marked by seven red conical buoys, No. 1 at the north entrance and No. 3 being surmounted by a staff and ball.

The east side is marked by five buoys; No. 1, a red and black horizontally striped spherical buoy with staff and diamond, lies in about 2¾ fathoms. It marks the divergence of the Noorder and Brielle

Gats. The others are black can buoys. These buoys are frequently shifted.

Rak van Scheelhoek.—This channel is marked on the west by two red conical buoys. A spherical buoy striped black and red horizontally, with staff and cone, lies off the southern end of the Rug van Scheelhoek, west side of fairway.

The east side is marked by three black can buoys, No. 3 with staff and truncated cone; and one black light buoy marked "Kwak," moored on the edge of the bank off Kwak Point, which shows an occulting red light every 10 seconds.

On the formation of ice the light buoy is replaced by a black spar buoy.

Tides and tidal currents.—The high water interval at Hellevoetsluis is 2 h. 43 m.; springs rise 6¾ feet.

At Hellevoetsluis the tide rises during five hours and falls for seven and one-fourth hours. In all the channels leading to that place the current runs in for a little more than four and one-half hours, while it runs out for fully seven hours. The water continues to rise only three hours during the flood, and with the ebb to fall about seven hours; during the last hour of the flood and the last two hours of the ebb the current runs with but little apparent variation in the depth of water.

Upon an average the water does not rise during the first hour and a half of flood more than one-fourth of its whole height. It attains its highest point during the succeeding two hours and remains nearly at that level until the ebb makes, at about one hour after high water at Hellevoetsluis. The flood current makes at about one and one-half hours after low water at that place.

During the first two hours of the ebb the water does not fall more than about 10 inches in each half hour, after which it falls about 1 foot in the same space of time, until toward the last of the ebb, when the fall is slight. From two hours before to one hour after low water, and from one and one-half hours before to one hour after high water at Hellevoetsluis the currents are weak.

Sometimes owing to prevailing winds the tides rise and fall with less regularity, particularly off Goeree, and the same cause will also influence their direction and velocity. With northerly and westerly winds the flood runs longer and rises higher, sometimes as much as 2 to 3 feet, and during gales considerably more, while southerly and easterly winds equally affect the ebb.

The ebb current of the river meeting the tidal current of the North Sea (which runs athwart the mouth of the channels) usually causes a rippling, and the junction of the two currents may be also discerned from the difference in color of the river and sea waters. With strong westerly gales this disturbance approaches nearer to the edge of the bank than when the wind is blowing off the land.

Close outside the gats the current runs northeast by east from five hours before to one hour before high water at Hellevoetsluis; then, until one hour after high water it is turning through east and south to southwest by west. It then runs four hours in that direction or until five hours after high water. It then, in the next two hours, or until five hours before high water, turns through west and north (the first of the rising tide and setting off shore) to northeast by east. This revolution of the tidal currents is with the hands of a watch, while southwestward of the Slyk Gat, along the coast, they revolve in the opposite direction.

In the offing, high water at Hellevoetsluis coincides with the third hour of the northeast current in the North Sea; that is, the third hour after high water at Dover, or tide and half tide.

Pilots.—Goeree pilots cruise in the neighborhood of Dungeness, and also in the offing abreast Slyk Gat in a sailing vessel, at from 4 to 8 miles seaward of the outer buoys, and within the limits of West Schouwen Lighthouse bearing 144° and Goeree Lighthouse 110°.

Directions for Goeree Gats.—In heavy weather a vessel, having the choice of entering Brouwershaven Gat, should not attempt the Goeree Gats. No stranger should willingly enter without a pilot. One can generally be obtained at sea, and always from within the bar.

Entering the Slyk Gat on an emergency without a pilot, the seaman should know which tidal current is running. During westerly gales, however, this is not so necessary as regards the height of the water, for it is then so pent up at the mouth of the gat that there is scarcely any perceptible fall during the ebb. This is the case only when storms from the westward have lasted a couple of days or more. With a southerly wind and a flood tide, a sailing vessel should head a little southward of the range mark, and vice versa, to prevent being set to leeward of it.

By Slyk Gat.—Vessels waiting a rise of tide to enter Slyk Gat usually anchor outside the outer or distinguishing buoy, in 6 or 7 fathoms, with Goedereede Church bearing 121° 30′; or, should circumstances render it necessary to continue under way, then keep Goedereede Church open eastward of the Verklikker and do not go into a less depth than 7 fathoms. When approaching the gat from the offing, keep Goedereede Church bearing 113°.

The range mark up to and through the entrance of the gat is Goedereede Church in line with Slyk Gat Lighthouse, bearing 102°, leads 600 yards southward of the distinguishing buoy at the entrance to the gat, and 800 yards northward of No. 1 red buoy within it. At about ½ mile eastward of this buoy is the outer bar, which has a low water depth of about 16½ feet with the lights in line and about 2 feet more on the nun buoy side of the channel, but subject to change.

From No. 1 red buoy the course must be regulated by the buoys, red to starboard and black to port when entering, as there are no range marks for the Slyk Gat. The buoys are kept as correctly charted as possible. The channel is narrow off Kwade Hoek, where it turns to the southward. Near the position of No. 2 red buoy off Kwade Hoek a tide gauge is placed; from abreast this buoy steer more to the eastward and pass through the Noord Pampus Channel, which has about 12 feet least water, into the Rak van Scheelhoek, and thence about 110° for Hellevoetsluis Road.

Small craft proceeding through the Zuider Deep, from off Goeree Harbor, steer by the shore and buoys. The depth in this part of the channel is (1909) about 16 feet, with lighthouses of Stellendam and Scharrezeepolder in line. When past Stellendam, the lighthouses of Goeree and Molenpolder in line lead through Zuider Deep until off the harbor of Dirksland, the entrance of which is marked by the Pieter Beacon; a tide gauge is also placed here. Proceeding farther eastward, steer by the buoys and pass through the Aardappelen Gat, with about 9 feet at low water (January, 1909), into the Haringvliet. Between Aardappelen Gat and Hellevoetsluis the Haringvliet is deep and is marked on the west side by red buoys.

By night.—The entrance is only navigable by those locally acquainted. To enter, steer toward the bar of the Slyk Gat, with Goeree (fixed white) Light in line with the occulting white light of Slyk Gat bearing 102° until the fixed white light of Westhoofd is sighted bearing 157°, when the course should be altered to pass just northward of light buoy No. 4, which shows an occulting white light; when ¼ mile east of this buoy Slyk Gat Light will change from red to white, and care should be taken to have the fixed white light of Hellevoetsluis open clear of the island of Goeree before this change takes place. Then steer to pass southward of No. 5 light buoy with an occulting red light, and southward of the light buoy off Kwade Hoek, which shows a group flashing red light. Thence steer for the Noord Pampus Channel, marked by two light buoys on its north side, which show group flashing and occulting red lights; thence to Hellevoetsluis, passing southward of Kwak Light Buoy with occulting red light.

To pass through Zuider Deep, after passing the light buoy off Kwade Hoek, bring the fixed white lights of Scharrezeepolder and Stellendam in line ahead, and keep them so until near the latter place, when steer to pass outside the mole and then bring Goeree (fixed) Light in line with Molenpolder (fixed white) Light 281° 30′. From off Dirksland the course is toward the light buoy with fixed red light in Aardappelen Gat.

By Bokke Gat.—To enter by the Bokke Gat, which has about 13 feet at low water and 20 feet at high water, subject to change, in its approach over the Hinder Bank, proceed as for the Slyk Gat as far as No. 4 red buoy. Then the fairway buoy of the Bokke Gat will be seen ahead. It may be passed on either side and course shaped to pass over the bar between Nos. 1 buoys on either side and thence between the others. There are no range marks.

The channel is deeper within the bar, from abreast No. 2 red buoy, up to Hellevoetsluis Road and Harbor. From No. 6 red buoy, southeastward of the Ribben, a southerly course leads along the Voorne shore, eastward of the Rug van Scheelhoek, the ridge in mid-channel, thence pass southward of the light buoy off Kwak Point to Hellevoetsluis.

Noorder or Nieuwe Gat has a low water depth of about 10 to 12 feet, with a rise of 7 feet, but is subject to constant change, and can only be used by those locally acquainted.

The distinguishing buoy at its entrance, No. 1 spherical, painted in red and black horizontal stripes, and surmounted by a staff and diamond, is in about 16 feet (within Maas Buoy), and the channel within is marked by red buoys on the starboard hand and black buoys on the port hand, on entering; it is very narrow abreast No. 3 red buoy. The channel course is roughly 172° from the outer buoy to abreast the west end of Voorne Island, just to the southward of which it unites with the Bokke Gat; thence to Hellevoetsluis the water is deeper.

West Maas Gat, a very narrow channel, leads from near Noorder Gat distinguishing buoy, across the Maas Flat, and along the north coast of Voorne to Brielle. It is described in the beginning of the next chapter.

Hellevoet Road, on either side of the entrance to the harbor of Hellevoetsluis, affords anchorage in depths of 9 to 10 fathoms. The anchorage here is good and capacious, with depths of 4 to 6 fathoms, but is subject to the drawbacks of being exposed to westerly gales and the strong flood currents produced by them, and in winter to the drift ice of the river.

The tidal current is stronger immediately off the harbor, where the road is narrowest, and vessels here moored obstruct the entrance. Anchorage is prohibited from abreast the west side of the entrance to about 800 yards westward, this space being reserved for firing exercises. (It is marked by beacons in line with one at the northwest extremity of the fortifications, on the bearings of 3° and 33°.) The best position for anchorage is apparently in the Lens, westward of these lines, where there is more room, avoiding the patches of 13 to 18 feet in and northward of the fairway. A narrow ridge with a least depth of 13 feet over it, and about 270 yards in extent in an easterly and westerly direction, is situated in the Lens, at 1 mile, 263°, from Hellevoetsluis Lighthouse, and about 670 yards farther to the northwestward is another small patch of 15 feet least water, also patches of 18 feet as charted.

Beacon.—A white floating beacon is moored in the roads.

Hellevoetsluis, on the southwest side of Voorne Island, is a fortified town, with a good harbor, the entrance being between piers extending a considerable way into the river, and it is also the sea outlet of the Voorne Canal.

Dockyard.—Here is a royal dockyard, arsenal, and other establishments pertaining to a naval station.

Dock.—There is a Government dry dock, with a depth of 18½ feet of water over the sill at high water springs. The dock is 500 feet in length over all and 53¾ feet wide in the entrance, and can be divided into two, each 237 feet in length. In the inner part of the depth on floor is only 14¼ feet.

Repairs.—No extensive repairs can be carried out at Hellevoetsluis.

Signals.—Hellevoetsluis is a telegraph station. Storm signals are shown.

A red flag displayed by day, or two fixed red lights, placed horizontally parallel to the direction of the harbor, exhibited at night, from either of the pierheads, indicates that entry into the marine harbor is prohibited.

Lifeboat.—A lifeboat is stationed at Hellevoetsluis.

Voorne Canal.—The entrance of the Voorne Canal is just eastward of Hellevoetsluis, and from a short distance within the entrance the canal crosses the island in a straight line to Nieuwe Sluis. By this route vessels may pass at all times in less than four hours from Hellevoet Road into Maas River, 9 miles below Rotterdam. It has now been superseded as the principal route to Rotterdam by the new canal through the Hook of Holland, known as the New Rotterdam Canal or Nieuwe Waterweg. It is, however, probably the deepest route to Brielle since the almost closing of the Brielle Gat route from the sea, over the Maas Flats, which has now only about 4 feet and is known as the West Maas Gat.

The canal is about 5½ miles in length, in a 54° direction, has double tidal locks at its extremities, 232 feet by 46 feet, and has a depth of from 17 to 20 feet, and is available for vessels up to 19½ feet draft. The width at the surface of the water is 112 feet, and there are four expansions, or sidings, at regular intervals, to enable vessels to pass each other. The canal is crossed by two floating bridges and two iron swing bridges, and it has a broad towing path on each side. Some vessels may have to lighten after leaving the canal before proceeding to Rotterdam through the Botlek, the depth in which in 1908 was about 8½ feet.

The canal pilots are furnished with the canal regulations in the French, English, and German languages, for the information of masters of vessels. To these regulations is fixed a tariff of charges for passing through the canal, including lock dues, port money, bridge tolls, etc., the amount of which varies according to the tonnage of the vessel and the place lately arrived from.

Voorne Canal Lights.—The lights shown on each side of the lock entrances and bridges for regulating the traffic through the Voorne Canal, Maas River, have the following signification:

Signal.	Signification.
Both lights red	Passage prohibited, lock gates closed.
One red, one green light	Passage prohibited, though gates may be open or closed.
Both lights green	Passage permitted, gates open, when this signal is displayed the gate at the other end of the lock will have a red light on it.
Two vertical red lights	Locking through is impossible.

River above Hellevoetsluis.—The channels above Hellevoetsluis are buoyed on the uniform system, with occasional light buoys showing occulting white lights. At about 3½ miles above Hellevoetsluis, on the north side of the Haringvliet, the Beningen Channel, marked at the entrance by a light buoy and with a least depth of 9 feet at low water (January, 1909), leads into the Spui, which, with Berengat at its eastern end, connects with the Oude Maas; the Spui has 8½ feet least water eastward of Oud Beierland, and the Berengat 8 feet. At the light buoy off Middelharnis Harbor the channel divides; one part, named the Vuile or Hitersche Gat, flowing northward of Tien Gementen Island, has 17 feet on its eastern bar where it joins Hollandsch Deep off Willemstad; this bar is marked by a light buoy. The channel southwestward of Tien Gementen Island leads to the Bommel, a buoyed and dredged channel with from 13 to 14 feet of water, leading also into Hollandsch Deep.

Vuile Gat—Depth.—A channel with a depth of 19 feet has been dredged across the bar at the eastern entrance to this channel.

Nieuwedyk Range Lights.—From brown hexagonal framework structures, with gray lanterns, erected near Nieuwendyk, on the northern shore of Vuile Gat, are exhibited fixed white range lights.

The front light, situated on the river bank, is elevated 26 feet.

The rear light, situated 480 yards, 304°, of the front light, is elevated 34 feet.

These lights in line, bearing 304°, lead through the dredged channel until abreast of the east point of Tien Gementen.

Winter.—The light buoys are replaced on the formation of ice by spar buoys, with the exception of that off Middelharnis and the black buoy off the Beningen.

CHAPTER IV.

HOOK OF HOLLAND TO THE TEXEL.

Brielle (West Maas) Gat.—The Maas Flat extends 3 miles seaward of Voorne Island and about 2 miles from the Hook of Holland, blocking the estuary of the Maas between, and being nearly dry in places at low water; two portions, the eastern of which is named the Schelpplaat, dries over 1 mile in extent. The swashways through it, the West Maas or Brielle Gat, and the old Maassluissche are very shallow and subject to constant change.

A red sector of the flashing light on the Noorddam, Hook of Holland, shows over the Maas Flat.

Depths.—Brielle Gat has a low water depth of about 4 feet, with a rise of 6½ feet, and is buoyed; the other apparently has less and is not buoyed. Brielle Channel is deeper within from abreast No. 2 buoys; at the west entrance of the Zuidwest Gat the depth is 9½ feet at low water. In 1908 there was not less than 14 feet, above Brielle, near the Domein Flat, thence to the New Rotterdam Canal the least depth in the Botlek was about 8 feet. It was formerly the principal channel of the Maas to Rotterdam and is indifferently termed the "Brielle" Gat and "West Maas" Gat.

Voorne has already been described as a low island fringed with sand hills on its seaward sides, and principally distinguished by the massive tower of Brielle Church. Steenen Beacon stands at the north extremity of the island, and the cupola of Zeeburg on the shore nearly 1½ miles to the westward.

Buoyage.—Maas Buoy lies in about 5 fathoms and marks the edge of Maas Gat as well as the approach to West Maas or Brielle Gat and the Nieuwe or Noorder Gat. It is a conical buoy painted in red and white horizontal stripes and marked "Maas" and is charted with the south mole light at the entrance to the Hook of Holland Canal, bearing 63° 30′, distant nearly 3 miles, and Brielle Church in line with Zeeburg Church on the coast.

Maassluis Buoy is in about 3½ fathoms, about 1.7 miles nearer to the south mole light just mentioned. It is a white nun buoy surmounted by a triangle and marked "Maassluis." It guards Maas

Bank and marks the approach to old Maassluissche Gat and the new waterway from the southward.

West Maas Gat and the channel to Brielle is marked by red conical buoys on the starboard hand and black can buoys on the port hand on entering. The outer red conical buoy is about ½ mile southward of the distinguishing buoy of Noorder Gat and 1 mile southward of Maas Buoy. It is marked 2 and is without a topmark. No. 1 can buoy has a truncated cone topmark.

As these buoys are altered with the changes in the banks, and their present position might continue for a very limited and uncertain time, it would be useless to describe them further.

Directions.—Brielle or West Maas Gat can only be used at near high water and by small vessels. The tidal stream setting across the outer part of Maas Flat renders the passage of the bar difficult for sailing craft with some winds. The shifting nature of the banks, however, renders the employment of a pilot necessary to a stranger. There is a canal with a depth of 14 feet leading from the Nieuwe Maas, below Brielle, through Rozenburg Island, into the New Rotterdam Canal; also the Botlek above Brielle, as mentioned heretofore.

Tidal currents.—In the channel the flood of ordinary tides runs for four hours, and the ebb runs a little more than seven hours, but during the last hour of both flood and ebb there is little apparent rise or fall. Each slack water usually lasts rather more than half an hour. As a rule the flood current runs from one to one and one-half hours after high water and the ebb for two hours after low water.

Lifeboat.—At Brielle Harbor, eastward of the town, is a lifeboat station.

Brielle is situated on the northern part of Voorne Island, about 7 miles within the bar of the gat of the same name. It is strongly fortified. All craft that are able to cross the bar can reach this place. The northern entrance of the Voorne Canal is 3.3 miles above Brielle and affords deeper water (about 18 feet) from the sea via Slyk Gat. There is a telegraph station at Brielle.

Brielle Harbor Lights.—A fixed white light is shown from the east and west moleheads.

Maas Light Vessel is moored in 12 fathoms at 7½ miles 286° 30′ from the northern molehead of New Rotterdam Canal and exhibits a group flashing white light. It is elevated 36 feet and is visible 11 miles. In bad weather the light is lowered 5 feet.

The light vessel, with main and jigger masts, is painted red, with a broad white streak, upon which, on either side, the name "Maas" is painted in black letters. The vessel carries a red cylinder at the mainmast head as a daymark. A white riding light is shown from the forestay.

A watch buoy, red, is moored 850 yards southeast of the vessel.

When from any cause the flashing light can not be exhibited, a fixed white light will be shown from the masthead and two white flares every 10 minutes from above the gunwale.

Should the light vessel drift from station, the usual lights will not be exhibited, but a fixed red light will be shown from each end of the vessel. By day a red flag will be hoisted above the red cylinder at the masthead.

Should a vessel be seen standing into danger, a gun will be fired from the light vessel, and repeated if necessary; and the signal flags J D of the International Code, signifying "You are standing into danger," will be hoisted and kept flying until answered.

A rocket immediately after a gun will indicate that assistance from the shore is required.

See "Caution," page —.

Fog signal.—A siren is sounded. Should the siren be out of order, the auxiliary fog signal will be made on the bell, immediately followed by short blasts from the hand foghorn.

A submarine fog bell is established on board the Maas Light Vessel. The bell will give four strokes every 12 seconds—thus: stroke, silent interval 2 seconds, stroke, silent interval 2 seconds, stroke, silent interval 2 seconds, stroke, silent interval 6 seconds.

Spoil buoys.—A red buoy, with ball, is temporarily placed 3 miles 318° of the north molehead of the New Rotterdam Canal, to mark the spot where dredged soil is deposited.

Wrecks.—Many wrecks lie in the vicinity of Maas Light Vessel, one being marked by a small conical red buoy.

Tidal currents at Maas Light Vessel:

Before high water at Dover.			After high water at Dover.		
Hours.	Direction.	Velocity.	Hours.	Direction.	Velocity.
		Knots.			*Knots.*
5	NE. by E. or SW. by S.[1]	0 to ½	1	SW. by W. or NE. by N.[2]	0 to 1
4	SW. by S.	0 to 1	2	NNE	¼ to 1¾
3	SW. by S.	¼ to 1½	3	NE. by N.	½ to 2
2	SW. by S.	½ to 1¾	4	NE. by N.	¾ to 2½
1	SW. by S.	½ to 1¾	5	NE. by N.	½ to 1¾
H. W.	SW.	0 to 1¼	6	NE.	¼ to 1

[1] With strong NE. by N. winds.

[2] With strong SW. by S. winds.

Toward the time of low water at Dover when the current is slackening and changing its direction from northeast by north through south to southwest by south it sets toward the shore. Under ordinary circumstances this tendency is of little consequence, but with northwest by west winds the set may be greatly increased and should be guarded against.

New Rotterdam Canal is an artificial channel through the Hook of Holland to the Scheur River. Above Maassluis the river is known as the Nieuwe Maas, and the whole as the Hook of Holland Canal. It forms the principal communication from the sea to Rotterdam and to Schiedam and Maassluis below it.

Moles or breakwaters, known as the Noorddam and Zuiddam, extend about 1 mile seaward from the original coast line. They are covered or awash in parts at high water, and the sea washes over them in heavy onshore gales. Beacons are erected at various distances along these moles, as shown on the plan. The Zuiddam has another breakwater named the Lagedam, northward of and parallel to it, and connected at its extremity named the Blinde Hoofd, with the Zuiddam. Three beacons with red truncated cone topmarks, showing about 11 feet above high water, extend in line in a southwesterly direction from off the outer end of the Zuiddam. The northeasternmost beacon is about ½ mile from the end of the dam, the intended prolongation of which they serve to indicate. The entrance is about 800 yards wide between the outer ends of the moles, the deeper water, 5 to 6 fathoms, being near the northern mole. A bank with less than 3 fathoms extends nearly halfway across from the southern moles. The depths signaled apply to the depths abreast the Hook, or about 1 mile within the mole lights.

Navigable depths to Rotterdam.—The least depth in the entrance to the canal on the line of the leading lights, and to about 1,400 yards above the entrance, is 30 feet at ordinary low water, but is subject to change; the channel thence to Rotterdam, distant 17 miles from the sea, has a least depth of 28 feet in the fairway for large vessels. The rise of tide at springs is about 6½ feet. The depth of water near and abreast Hook of Holland is shown from the tidal signal staff.

Ice.—The navigation from sea to Rotterdam is stated to be open at all times. In January, 1891 (an exceptionally severe winter), it was open, at which time the Schelde was blocked. Steamers, however meet with delays and sometimes can not unload when the navigation higher up is closed. In the winter of 1906–7 drift ice existed below Maassluis for 48 days, but the seagoing traffic was not interrupted, and river steamer traffic was closed for one day only.

Tides.—The tide at the entrance to the canal occupies four hours in rising, remains stationary for nearly four hours, and falls for five hours; it has been known to attain a height of 6½ feet above the average level of high water and to fall 4 feet below that of low water.

The highest tide occurs at two and a half days after new and full moon.

Tidal currents.—With upriver floods and easterly and southerly winds, it sometimes occurs that, at neap tides, the flood current is hardly perceptible in the canal entrance. The water also then rises less than in the case when westerly winds prevail.

Under ordinary circumstances the tidal current runs into the canal from three hours before high water to one hour after, remains stationary for a short time, and then run outward. The incoming current attains its greatest velocity between one and a half hours before high water and the time of high water; the outgoing current is strongest at between three and five hours after high water.

The junction of the outgoing current with the tidal current outside the canal is marked by tide rips, and during strong northwest by west winds a dangerous sea rises at the entrance to the canal.

With strong southwest by south winds the best time to enter is at about one hour after high water.

The flood current in the canal runs with its greatest velocity from one to two hours before high water, and the ebb attains its greatest strength at from three to five hours after high water.

At high water the current outside is running at its maximum velocity northeastward, and at low water in the reverse direction.

Obstructions—Wreck signals.—In the event of a wreck being situated between the moles of the Hook of Holland, in a position obstructing the fairway, a red flag will be shown by day and a fixed red light by night from the tidal signal mast until the wreck itself can be marked in accordance with the Netherlands system.

Lights.—Maas Light Vessel in the approach.

Light and whistle buoy.—A black and red vertically striped buoy, marked "N. R. W.," with whistle and an occulting white light every 10 seconds, is moored about 2¼ miles, 292°, from the light on the north mole of the canal entrance.

Light buoy.—A red buoy, exhibiting an occulting white light every 10 seconds, is moored about 3¼ miles northward of the light on the outer end of the north mole of the canal entrance.

Noorderhoofd Light is flashing, with white and red sectors, visible 12 miles, and is exhibited from a red iron tower with gray lantern, at a height of 43 feet, on the north molehead. (See Light List.)

Foghorn.—During thick or foggy weather a foghorn at Noorderhoofd Lighthouse is sounded. Should the foghorn at the lighthouse be out of order, a signal will be sounded near the middle of the dam instead.

Lagedam Light is fixed white, exhibited, at a height of 30 feet, from a wooden frame at about 71 yards within the extremity of the Lagedam, which lies parallel to the Zuiddam.

Noordwal Range Lights.—At Berghaven on the north side of the canal are two range lights for the entrance. The rear light is group flashing white and exhibited, at a height of 95 feet, from a brown iron tower; it is visible 15 miles.

The front light, fixed red, is shown from a dark red tower with gray lantern on the east dam, Berghaven, at an elevation of 47 feet and is visible 12 miles.

This light is screened so as to be visible only for 10° on each side of the range line, viz, from the bearing of 98° to 118°.

These lights, in the rear, lead in the fairway from seaward between the entrance piers.

On each side of the range line, from the bearing of 106° to 110°, the rear light shows between the flashes as a fixed white light of less power than the flashes.

When inshore of a line joining the Hook of Holland to Slyk Gat fairway buoy, the rear light appears as a flashing light.

Westward of Berghaven are two fixed white lights, 79 and 25 feet high, respectively, and 312°, 530 yards apart, visible only up river for the navigation of the reach above Berghaven.

Buoys and beacons.—A gas and whistle buoy and a light buoy are moored seaward of the entrance to the canal and have been mentioned with the lights.

The approach and also the canal is marked by red conical buoys on the starboard hand and black can buoys on the port hand on entering, as charted. Nos. 1, 2, and 10, red, each have balls as topmarks; No. 5, black buoy, has a truncated cone as topmark; they are moved to meet changes in the channel when required. Two unnumbered buoys have been moored at the entrance; a black buoy between black buoys Nos. 1 and 2; a conical buoy between conical buoys Nos. 4 and 5. There are mooring buoys in places on south side of the fairway of the canal.

Beacons are erected at various distances apart on the north and south moles, as before mentioned.

Between Berghaven and Maassluis the channel is marked by twelve occulting red lights on poles or dolphins with conical daymarks on the north side, and one occulting green with twelve occulting white lights on poles on the south side. These lights are shown on the dams along the fairway of the canal.

When temporarily extinguished a dolphin is marked as a wreck.

Lifeboats.—There is a lifeboat at the inner end of the Noorddam, one in Berghaven, and one at Maassluis, up river; at Berghaven there is also a rocket station and another on the opposite side of the canal abreast the tidal signal staff.

A telegraph and signal flagstaff is situated on the north bank eastward of the tidal signal station at the entrance to the canal. The signal station is connected with Lloyd's.

A radio station has been established at the Hook of Holland, where messages can be received and forwarded.

Storm signals are shown from Berghaven. The night signal is only visible inward. A storm signal and telegraph station is at Maassluis, 6 miles above.

Storm signals are shown from the signal staff at Hook of Holland, Maassluis, and Rotterdam, as follows:

Black ball	Be on your guard (at night this signal is given by a red light).
Cone, point downward	Expect stormy weather from southwest.
Cone, point upward	Expect stormy weather from northwest.
Two cones, vertical, points downward	Expect stormy weather from southeast.
Two cones, vertical, points upward	Expect stormy weather from northeast.
Pennant	Wind veering, or with the hands of the clock.
Two pennants	Wind backing, the reverse.

Pilots.—Two steam pilot vessels cruise from 4 to 6 miles seaward of the light buoy, the one northward and the other southward of the entrance. In the entrance is a pilot cutter which receives pilots from outward-bound vessels. The pilots are licensed to take vessels as far up as Maassluis. Vessels going farther up are provided at that place with a river pilot.

Waiting tide.—As a rule most vessels can enter on arrival, but those of deep draft may have to wait for tide, in which case a steam vessel might anchor northward of the fairway in 6 or 7 fathoms, even bottom. Sailing vessels should keep westward of the fairway to avail themselves of the north-going or fair tidal current when about to enter.

Tugs are available.

Directions for New Rotterdam Canal.—By day or night make the Maas Light Vessel (temporarily replaced by a light and whistle buoy, 1918).

The blunt towers of Monster and Brielle Churches, some 3 miles northward and southward, respectively, of the entrance, are seen in fine weather some miles outside it. From abreast the light vessel the canal entrance is rendered conspicuous by the lighthouses and other buildings on either side.

It must be remembered that toward high water at the canal entrance the current outside the piers is setting at its maximum strength to the northeastward or across the entrance. The current outside is slack at about half tide.

The Maas Light Vessel is moored nearly on the line of the range lights for the fairway of the fixed entrance. These lights, the rear group flashing white and the front red, or by day the lighthouses, the rear brown cylindrical and the front red octagonal, should be steered for, in line on the bearing 108°, which will lead about 200 yards southward of the north mole, between the red conical buoys on the starboard hand and black can buoys on the port, in a depth of about 30 feet at low water, as far in as No. 5 red or No. 2 black buoy; the depth near and abreast the tidal signal staff is signaled from it near the inner end of the Noorddam.

From Nos. 5 and 2 buoys above mentioned a course should be kept midway between the red buoys and the northern bank of the canal and between the beacons on either side until black buoys are again met with. Several pairs of range lights (for which see Light List and chart) are established for leading up the various reaches to Rotterdam, available with local knowledge; also 12 dolphins on the north side and 13 on the south side of the channel, all of which show occulting lights at night. There is not less than 26½ feet in the fairway for large vessels to Rotterdam, but is subject to change, and vessels must of necessity be in charge of a pilot, who is always obtainable, and sunken wrecks may possibly obstruct the fairway.

Mooring buoys are situated in the canal off Berghaven, where vessels can await tide or lighten before going upriver.

Vessels can secure between dolphins on the port hand entering. There are two berths for vessels of 250 feet and over, known as "E" and "F," "E" being the first large dolphins on entering.

Permission to use "E" should be obtained from the Netherlands Government; permission to use "F" from the Netherlands Railway Co.

Vessels can moor at the eastern end of Rozenburg for the purpose of loading or discharging explosives.

Hook of Holland.—The small town of this name is situated on the north side of entrance to the New Rotterdam Canal. It has a fort, post office, etc., and is connected by a railway with Rotterdam.

Berghaven is a harbor on the north bank, close eastward of the Hook of Holland town. It is available for small craft, having a low water depth of 9 feet in it.

Towns below Rotterdam.—Schiedam, with a population of 33,882 is situated about 3½ miles below Rotterdam. Delfshaven is between Rotterdam and Schiedam, and is entered by locks through the Ruige Plaat. Vlaardingen and Maassluis are 2½ and 6½ miles, respectively, below Schiedam, all on the north side of the canal, the latter being about 6 miles above Berghaven. The fishing village of Pernis is on the south bank, 1 mile below Schiedam.

Time signal.—There is a time signal on the water tower at Delfshaven.

Port of Rotterdam.—Rotterdam, the second city of Holland, is upon the right or northern bank of the Merewede, or Nieuwe Maas, 17 miles above the entrance of the New Rotterdam Canal. Like most Dutch towns, Rotterdam is extensively intersected by canals, some of which, from their ample width might be termed havens, and several of them are deep enough to admit of large vessels lying alongside the warehouses in the middle of the town, but are now only used by vessels engaged in the navigation of inland waters.

Noordereiland (North Island), 1,410 yards long by 220 yards broad, lies in the middle of the river abreast the old town. It is connected to the right bank by two fixed bridges and to the left bank by two swing bridges across the Koningshaven. The railway crosses the river on the eastern bridges.

The island is surrounded by quays. The Maaskade, on the north side, is 1,520 yards long, with low water depths of 10 to 19 feet alongside westward of the bridges and about 10 feet to the eastward. The Prins Hendrikkade, on the south side, has a length of 1,420 yards, with 18 feet alongside at low water.

Moorings.—Near the center of the river, and extending for a distance of about 2 miles below the bridges, are lines of moorings, in from 5 to 6 fathoms, capable of accommodating about 29 large vessels, with access to both sides for lighters to come alongside.

Quays.—The quays and havens commence at the Ruige Plaat, abreast Delfshaven, about 2 miles below the bridges.

North shore.—**The principal quays** on the north side of the river below the bridges are the Westerkade, Willemskade, and the Boompjes, the three combined being rather over 1 mile in length, with low water depths of 16 to 23 feet. These, with a portion of the Parkkade (just below the Westerkade), are nearly all appropriated by British steamship companies.

The principal havens or wet docks on the north side, commencing from the westward, are Schiehaven, with low water depths of 27 to 28 feet, and 1,465 yards of quay; St. Jobshaven, with 27 to 28 feet, and 875 yards of quayage; and Parkhaven, with 24½ to 26 feet of water, and 1,160 yards of quayage.

Within the quays are numerous canals and havens with depths ranging from 13 to 20 feet, not now used by seagoing vessels.

South shore.—**The principal havens** and quays on the south side are the Kortenoordsche Haven, with low water depths of 23 to 26 feet, and 350 yards of quayage; St. Jans Kade, belonging to three petroleum companies, 930 yards long with 23 to 26 feet water alongside; Dokhaven, with 19 to 36 feet; Maashaven has an area of 142 acres with 27 to 28 feet of water.

The two Katendrechtsche Havens have 24 feet of water and, together, 1,150 yards of quay; Katendrechtschekade, three short quays, is 390 yards long with 23 feet water; Rijnhaven has an area of 74 acres and 23 to 27½ feet; Wilhelminakade is 930 yards long, with from 24 to 27½ feet alongside (used by the Holland-America and Rotterdam Lloyd's Steamship Co.'s); Spoorweghaven with 23 to 24 feet and 2,200 yards of quay space.

Binnenhaven has 2,185 yards of quayage and 21 to 23 feet of water; Entrepot Haven, off the Binnenhaven, has 500 yards of quayage and 23 feet of water; Stieltjeskade, in Koningshaven, below the bridges, is 355 yards long with 19 to 21 feet alongside; Nassau Kade, above the bridges, is 665 yards long with 19 feet of water.

These southern quays and havens are connected with the railways and are provided with steam, hydraulic, and electric cranes lifting from 1½ to 34 tons; at Feyenoord there is a 60-ton crane.

Maashaven is 460 feet wide in the entrance with a maximum breadth of 1,050 feet, but has only 328 yards of quay, situated on the east side of entrance. There are dolphins in the haven, to which 23 vessels can moor for the transshipment of cargo into lighters or Rhine boats.

Rijnhaven is 460 feet wide in the entrance with a maximum breadth of 1,500 feet, and besides its extensive quayage, has dolphins to which 16 vessels can moor in it with access to both sides for lighters to come alongside.

The above havens and quays are tidal, and there are no locks to pass. They can be used by vessels drawing 16 to 24 feet, according to draft. An extension of the basin accommodation on the left bank of the river is proposed. It will be named the Waalhaven Basin, with a total area of 766 acres.

The Koningshaven is the navigable channel between North Island and the south shore of the river. It has low water depths of 20 to 22 feet and is crossed by two swing bridges.

Above the bridges there are many other havens and quays.

Bridges.—Vessels of 18 feet draft may only pass through the bridges when the current is flowing upriver. Large seagoing vessels passing through the bridges with the current must have a tug astern capable of stopping them if required. Such vessels may be prohibited from passing the bridges with the current.

Anchorage.—Vessels are permitted to anchor off the quays at the west end and north side of North Island, southward of the mooring buoys; also eastward of Feyenoord on both sides of the river.

Docks and slips.—The city of Rotterdam owns four floating docks, the largest of which is 588 feet long, 90 feet wide in the entrance at water level, with a depth of 25 feet on the sill; it has a lifting power of 15,600 tons and is stationed in the Maashaven. The other three are in the Dokhaven. There are three floating docks owned privately.

Rotterdam.—The population of the city is about 136,000, engaged chiefly in commercial pursuits. It has in normal times quite a large foreign trade.

The United States is represented by a consul general, a vice and deputy consul general at Rotterdam.

Sailors' home.—There is a large sailors' home in Rotterdam (Westhaven No. 11) open to seamen without distinction of religion or nationality. There is also a sailors' rest (Terwenaker No. 12), with reading and recreation rooms.

Communication in normal times is maintained with London, Leith, Hull, Yarmouth, Dunkerque, Havre, Antwerp, and other foreign ports by several steamship companies.

The town is connected by railways via Delft and The Hague (Gravenhage) with Amsterdam, 38 miles, Utrecht, Antwerp, and thence to all parts of the Continent.

Tugs are always at hand to assist vessels.

Telegraph.—The telegraph office is always open.

Repairs.—At Rotterdam, Charlois, and the vicinity there are several large shipbuilding yards, where vessels of 1,000 to 1,500 tons are built; also extensive factories for steam and other engines. At Feyenoord, just opposite the city, there is a large establishment where most of the Government steam vessels have been built and fitted with engines, etc. Up the river there are numerous small shipbuilding yards and manufactories within easy reach of the city.

There is a salvage company in Rotterdam who keep a large plant at Hook of Holland and Maassluis ready for immediate use.

Regulations.—Vessels laden or partly laden with explosives or inflammable substances must be towed through Nieuwe Maas, and if their masts can be lowered pass northward of North Island, otherwise passing through Koningshaven.

In dark or foggy weather and at night the passage of such vessels is prohibited.

Such vessels discharging cargo at Rotterdam can only lie at the quay fronting the petroleum storehouses and are under the supervision of the harbor police.

Floats navigating the Nieuwe Maas must not exceed 230 feet in length and 59 feet in breadth unless special permission has been obtained; floats must not pass through Koningshaven.

Electric lights used in working cargo must be screened, so as not to interfere with the navigation of passing vessels.

When passing through Koningshaven vessels keep on their own starboard sides of the channel and proceed at reduced speed. The general navigation of Koningshaven is regulated by the harbor police.

Coal for steaming purposes can be obtained, but no large stock for that purpose is kept. Should a large quantity be required, one or two days' previous notice must be given. Coaling is performed either from barges or at the coal tips on the quays, alongside which there are depths of 23 feet, as before stated. There are two hydraulic coal tips in the Binnenhaven for loading and discharging coal, also one at the Katendrechtschekade.

Supplies.—Fresh provisions are always obtainable. Good water is supplied alongside by steamer.

Quarantine.—The quarantine station is at the quay outside the Kortenoordschehaven, on the south shore, about 2½ miles below the bridges.

Time signal.—The signal is made daily, except Sundays, from the Gate Building at Feyenoord and consists of four black circular disks, 90 feet above the ground, which are placed perpendicularly, as preparatory, five minutes before the signal, and fall into a horizontal position at noon legal time, equivalent to 22 h. 40 m. 28 s. Greenwich mean time.

A time ball is dropped daily from the water tower, Ruige Plaat, at 0 h. 00 m. 00 s. noon legal time, corresponding to 22 h. 40 m. 28 s. Greenwich mean time.

Chronometers can be compared at the observatory from noon till 2 p. m.

NOTE.—Rotterdam has adopted the daylight-saving system, and the time signal is sent out to correspond with it.

Tides.—The high water interval at Rotterdam is 3 h. 59 m.; springs rise 5½ feet. The flood current usually runs for four hours and the ebb for seven and one-half hours. (See General Tide Tables, and also H. O. Charts 5201 to 5224, inclusive, for graphic representation of the currents of the North Sea and around the British Islands.)

The coast—Aspect.—From the Hook of Holland an unbroken line of coast extends northeastward for 66 miles to Kykduin, near the Texel, presenting throughout a broad margin of sand hills, bounding a low and wooded country. These sand hills protect the country from inundation by the sea, which, it is an interesting fact to remember, has assisted in raising this barrier against its own encroachments. The sand is said to be gaining slowly in extent and stability seaward. The only objects which now and then tend to relieve the monotony of the scene for many miles are the tower of a village church with its bluff top or diminutive spire showing above the downs, some beacons, and some fishing boats drawn up on the beach.

It is worthy of remark that along the whole of this extent of coast not the smallest portion of rock is found, and there is only one sand bank, the Petten Polder, detached from the shore. On the other hand, the water is shallow throughout, the 10-fathom curve being about 4 miles from the shore off the entrance of New Rotterdam Canal, gradually increasing its distance to 15 miles northward of Ymuiden, and is close to the edge of the banks of the Texel.

The following is a description of the several objects as they occur between the New Rotterdam Canal and Kykduin, and which are useful in recognizing the coast:

Gravezande Church, about 2 miles northward of the canal and 1 mile inland; Monster, about 1 mile beyond and nearer the coast has a massive square tower; Ter Heyde, near Monster, is a small village close to the shore, and 3.8 miles northeast of the canal; Loosduinen Church, about 3 miles 65° from Ter Heyde, has a tower with a small turret upon it.

Near Loosduinen, on the outer dunes, is a bathing establishment among some houses. Between Monster and Loosduinen the high water tower of Delft will be seen.

Lifeboat and telegraph stations.—Lifeboats are stationed at Vluchtenburg, Ter Heyde, on the shore abreast Loosduinen, and at Scheveningen. There is a storm signal station at Ter Heyde and also at Scheveningen.

Gravezande, Monster, Ter Heyde, Loosduinen, and Scheveningen are telegraph stations; the latter is also a signal station.

Scheveningen—The Hague.—Scheveningen, a bathing village in connection with The Hague (Gravenhage), which is only 2 miles distant, has, owing to its vicinity to the royal residence and the seat of government, become a place of considerable importance. It stands close upon the shore and its church has a tower surmounted by a spire. Extensive bathhouses are on the sand hills just eastward of the village. The largest building is the Kurhaus, northeastward of the village, opposite the promenade pier. The steeples of The Hague are also visible behind. A conspicuous water tower stands about 1½ miles northeastward of the village and ½ mile from the shore. The United States is represented by a consular agent.

There is a signal, storm signal, telegraph, and lifeboat station here, as before mentioned.

Depths.—The 5-fathom curve is about 1 mile off the shore at Scheveningen, shelving gradually within it.

Telegraph cable.—A telegraph cable to the English coast is laid in a 274° direction from the shore, ¼ mile westward of Scheveningen Lighthouse.

A radio station is located at Scheveningen Harbor for the receipt and dispatch of telegrams from or to vessels.

The station is open night and day, the call letters being "P C H."

The weather signals consist of notices to mariners and meteorological data for Helder, Vlissingen, Gris-Nez, and La Hague in the form of two groups of five figures each, and for Yarmouth, Shields, Skudesnaes, and Sylt in the form of two groups, the first of five and the second of four figures, sent out at 11.15 a. m. and 11.15 p. m. (Sundays and holidays excepted), and preceded by the letters K N M I.

In the event of a storm signal being made on Sundays and holidays the signal will be preceded by the letters K N M I, and if a notice to mariners is to be sent out it will be preceded by the letters N B A Z.

FIRST GROUP.

The first three figures indicate the barometer at 0 or sea level, thus: Bar. 745.8 mm. is given 458; bar. 776.3 mm. is given 763.

The last two figures indicate the direction of the wind as shown in the accompanying table:

NNE	02	ESE	10	SSW	18	WNW	26
NE	04	SE	12	SW	20	NW	28
ENE	06	SSE	14	WSW	22	NNW	30
E	08	S	16	W	24	N	32

Calm is expressed by 00.

SECOND GROUP.

The first figure indicates the strength of the wind in accordance with a scale similar to the Beaufort scale, beginning with calm 0 and extending to 9, as follows:

0	Calm.	4	Moderate breeze.	8	Stormy.
1	Light air.	5	Fresh breeze.	9	Storm.
2	Light breeze.	6	Stiff breeze.		
3	Gentle breeze.	7	Strong wind.		

The second figure indicates the state of the sky and weather in accordance with the following table:

0	Fair.	4	Overcast.	7	Misty.
1	Slightly cloudy.	5	Rain.	8	Fog.
2	Cloudy.	6	Snow.	9	Storm.
3	Very cloudy.				

The third and fourth figures indicate the temperature (centigrade), and temperatures below 0° have the number 50 added in each case, thus: 6° is given as 56, 11° as 61, etc.

The fifth figure indicates the state of the sea and is given in accordance with the following table:

0	Calm.	4	Moderate.	7	High.
1	Nearly calm.	5	Rough.	8	Very high.
2	Smooth.	6	Very rough.	9	Phenomenal.
3	Slight.				

The following is a graphic illustration of this method for the first and fifth stations:

K N M I 69010 21541
57316 4405

Interpretation.

Place.	Bar.	Direction of wind.	Strength of wind.	Sky.	Temp.	State of sea.
Helder	769.0	ESE.	2	Slightly cloudy	−4	Nearly calm.
Flushing						
Gris-Nez						
La Hague						
Yarmouth	757.3	S.	4	Overcast	+5	
Shields						
Skudesnaes						
Sylt						

Following the weather signals, which are given three times at each sending, the first rapidly and the second and third slowly, storm signals and notices to mariners are sent out first in Dutch and then in English; for instance: First, attention signal, then signal for storm; second notice to mariners, preceded by the letters N B A Z.

In the event of no signal for a station, the letter X will be sent as a substitute.

Harbor.—There is a harbor for fishing boats.

Scheveningen Lights.—From a dark brown tower 98 feet high, on a sand hill at the south end of Scheveningen, is exhibited, at 160 feet above high water, a group flashing white light, visible 18 miles.

A fixed light on the head of the south mole shows green seaward and red over the harbor.

A fixed light on the head of the north mole shows red seaward and green over the harbor.

Both lights are elevated 44 feet above high water and are visible 3 miles.

A fixed white light is shown from the head of the promenade pier situated 1 mile northeastward of the harbor.

Fog signal.—A foghorn is situated at the head of the south mole.

Coast.—**Katwijk aan Zee,** 7 miles northeastward of Scheveningen, at the mouth of the Rhine River, has to the southward of it an extensive bathing establishment and gray lighthouse. The church with a white tower is a large white building. There is also another church with a tower and spire 170 feet high. The Rhine at Katwijk aan Zee communicates with the sea by means of a sluice, situated a short distance northeastward of the village; near the sluice are two high chimneys. The original mouth of the river was here, but owing to very extensive alterations in the configuration of the country its waters now discharge into the Maas by means of the Waal and Lek Rivers and into the Zuider Zee through the Vecht and Yssel.

Between this village and Scheveningen the steeple of Wassenaar, the water tower of Leyden, and the massive tower of Rijnsburg may be seen.

Noordwijk aan Zee, 2½ miles from Katwijk aan Zee, has a church with a belfry and a high pitched roof. Noordwijk Church, close within it, has a massive square tower and stunted spire. A large square bathing establishment stands on the summit of a high sand hill southwest of the village. The hummocks on the land here appear somewhat higher than those to the southward.

Noordwijk aan Zee Light, fixed white, visible about 8 miles, and shown at Noordwijk aan Zee, is a fishing light.

Zandvoort, nearly 9 miles from Noordwijk, has a church with a spire and a large white hotel with outbuildings. The steeples of Haarlem are nearly always visible inland of Zandvoort. The dunes here appear dark colored, being covered with vegetation; northward of Zandvoort is a high white sand hill. Three submarine telegraph cables leave the shore at Zandvoort in a westerly direction.

Lifeboat and signal stations.—There are lifeboat stations at Katwijk aan Zee, Noordwijk aan Zee, and Zandvoort; telegraph stations at the two first-named places and also at Noordwijk, about a mile inland. Storm signals are shown at Katwijk aan Zee and Zandvoort, but there is no night signal at the latter place.

Ymuiden Harbor is the artificial harbor forming the approach to the Amsterdam North Sea Ship Canal. It is inclosed by two moles, each 1,700 yards in length, extending from the shore at a distance of 1,300 yards apart. These converge so as to leave an entrance about 284 yards in width with a navigable width of 230 yards, inclosing a harbor 250 acres in extent, with a depth of not less than 31 feet at low water through its buoyed center portion leading to the canal, decreasing toward the moles, the depths being 3 fathoms and less at a short distance north and south of the buoys. The harbor has proved itself a place of considerable value as a refuge during gales.

Vessels up to 30 feet draft can ascend to Amsterdam by the canal, depending on the depth in the canal, and vessels of 26 to 27 feet draft could moor in Ymuiden Harbor in cases of emergency, but they would be in the fairway leading to the canal. The least depth in the fairway up to Lock A is shown from the signal staff.

Dredging is constantly going on to remove the sand which accumulates in the entrance and largely on the north side of the harbor. Westerly gales decrease the depth at the entrance, but it is restored by dredging as soon as practicable.

With a heavy sea from northwest, the north mole is covered by it, and it is not advisable to remain in the outer harbor, but to move up the harbor near to the locks, where there is perfect security.

At the inner end of the harbor are the two piers, named the North and South Crib, between and within which is the channel leading to the ship canal. It is about 110 yards in width with a least depth of about 31 feet at low water. Not less water will be found up to Lock A, but in the approach to the old locks the depth is 25 feet at low water.

Pilots.—A steam pilot vessel cruises off Ymuiden Harbor and carries at the masthead, by day, a blue flag with a number on it in white; at night, a flare-up every 15 minutes is shown. The usual side lights are carried, except when at anchor, and at the masthead a white light over a red light, vertical and 6 feet apart, visible in all directions. In fog, mist, falling snow, or heavy rainstorms a siren will give the following signal: Long blast, interval of 1 second; long blast, interval of 1 second; long blast, interval of about 105 seconds. The distinguishing signal for this vessel is a black and white vertically striped flag, with the Netherlands colors in the corner, hoisted at the mizzen. A schooner, painted black, cruises in the English Channel off Dungeness, carrying in her mainsail the words "Texel en Ymuiden" in black letters, and showing the blue flag and flare light described above, with a fixed white light at the masthead in addition.

Tugs.—Under all circumstances sailing vessels are recommended to take a tug before entering the harbor.

Buoyage—Light buoy.—A light and whistle buoy, painted in red and black vertical stripes and marked "Ijmuiden," has been established in the approach to Ymuiden Harbor at about 2¾ miles to the northwestward of the moleheads; it shows at an elevation of 26 feet above the sea an occulting white light every 10 seconds, and is visible 8 miles.

A light and whistle buoy showing an occulting red light has been established off Ymuiden in about latitude 52° 28′ N., longitude 4° 22′ E.

Black can buoys mark the north side and red conical buoys the south side of the deep-water portion of Ymuiden Harbor and the entrance to the canal, numbered inward from 1 to 5.

Three wreck buoys are moored between Ymuiden and the Texel; caution must be used and a lookout kept for unmarked wrecks also.

Ymuiden Harbor Lights.—The range lights are on the southeast side of the harbor and bear from each other 105°, 612 yards apart; when in line they lead into Ymuiden Harbor.

The rear or eastern light is flashing white, at an elevation of 170 feet above high water, and is visible 19 miles.

The front light is fixed white, elevated 101 feet above high water and visible 14 miles.

The lighthouses are red circular towers.

The fog signal.—A foghorn is sounded from the head of the south mole, and should this become disabled the horn situated on the gallery of the lighthouse of the western range light will be sounded.

Mole lights.—On the head of the south mole there is a fixed light showing green seaward and red in the harbor.

On the head of the north mole there is a fixed light, red seaward and green in the harbor. Each light is exhibited from a black iron frame with gray lantern.

Crib lights.—North Crib shows red over the outer harbor and green over the inner harbor. The light on the South Crib shows green over the outer harbor and red over the inner harbor; both are occulting.

Canal lights.—Below the fort, north side of approach to the canal, is a fixed light, showing red seaward and green toward the canal, shown from a black iron post. Fixed electric lights are shown on black iron frames on each side of the entrance to the Fish Harbor. The starboard hand one on entering or leaving shows green and the port hand one red.

Landmarks.—In approaching Ymuiden, besides the lighthouses, there can be distinguished the sharp spire of the Catholic Church, the small tower of the Protestant Church, the house of Willem Barends, surmounted by a small cupola, the large square house of the director, and the signal station, all on the southern side of the harbor. To the northward of the entrance, the fort and the beacon close northward of it are the most conspicuous objects. The latter, named the Kompaskaap, is a black skeleton iron structure, surmounted by a framework screen shaped like a dovecot, the whole 70 feet high, and bearing 77° 05′ from the lighthouse on the south molehead.

Directions.—Ymuiden Harbor is easy of access. To enter, steer in with the range mark lighthouses at the head of the harbor in line, bearing 105°. This leads into and through the harbor between the buoys on either side up to No. 5 buoys, whence course should be altered to pass midway between the wharves forming the approach to the canal if about to enter it. Or anchorage may be taken in the harbor, according to draft, remembering that the water shoals quickly within the buoys.

A convenient berth for vessels of war is alongside a wharf situated on the southern side at 200 yards eastward of the entrance to the Fish Harbor.

Vessels here are berthed alongside dolphins; it is desirable to secure with one dolphin amidships, to prevent drifting toward the shore, which is very close.

The tidal signals indicate the depth in the fairway only.

In entering it must be borne in mind that the offing current begins to run northeastward at from about two and one-half to three hours before high water at Ymuiden, and therefore it is running at its maximum strength (1¾ miles) at about high water across the entrance. The flood current is banked up at the back of the south mole, and its direction becomes diverted along it toward the offing. After having passed the end of the mole the current, thus increased, at first inclines a little toward the entrance, but soon takes its normal course along the coast. A portion of the flood tide produces a set to the southward across the approach to the canal.

The south-going current attains a velocity of 1¼ knots, and its duration is much influenced by the wind; slack water lasts a very short time.

The prevailing winds are southwesterly, but the most violent storms are from the northwest.

The town of Ymuiden, at the entrance to the canal, is growing rapidly. The harbor for the fishing craft (with an area of 17¼ acres and a depth of 19 feet) and the Government auction hall for the fish sales are well worthy of a visit by those interested in the trade; it is intended to largely increase the accommodation for the fishing craft, and another harbor is being constructed. The town is connected with the Netherlands railway system.

There are no harbor dues.

Signals.—Ymuiden is a signal and telegraph station; signals are shown from a mast close northward of the front lighthouse. The telegraph office is open till midnight.

Coal.—A limited amount is kept in stock under normal conditions.

Storm signals are shown from a dune to the southward of the signal station, and also from the islet situated between the channels leading to the Great and Old Sluices.

Lifeboats.—There is a lifeboat station both north and south of the port, and also inside the harbor on the north side eastward of the fort.

Tides.—The high water interval at Ymuiden is 2 h. 51 m.; springs rise 6½ feet. Winds from seaward may increase the rise by about 1 foot and offshore winds decrease it to the same extent. With gales from seaward the tide rises sometimes 9 or 10 feet; and with strong land gales it may not rise more than 3 feet. The flood current is generally stronger than the ebb. The tide rises for four and one-half hours only and ebbs for eight hours, but there is no fall of the water after the fifth or sixth hour, and at about springs there is a slight rise of a few inches after fourth hour, falling again after the fifth hour to the normal low water. There is a slack, therefore, between low water and the first rise of two to three hours.

Ordinary low water is reckoned as 3 feet below the mean water level at Amsterdam. (See General Tide Tables.)

Ymuiden tidal signals.—The following signals are used at night to indicate the depth of water in the channel to the inner end of the outer harbor. They are made from a signal apparatus at the semaphore near the front lighthouse on the south side of the approach to the canal.

By night the signals are made with white and green lights hoisted vertically, the white and the green lights being on separate hoists, as follows:

One green light, 23½ feet.
Two green lights, 24¼ feet.
Three green lights, 24¾ feet.
Four green lights, 25½ feet.
One white light, 26⅛ feet.
One green and one white light, 26⅝ feet.
Two green and one white light, 27½ feet.
Three green and one white light, 28⅛ feet.
Four green and one white light, 28⅝ feet.
Two white lights, 29½ feet.
One green and two white lights, 30⅛ feet.
Two green and two white lights, 30¾ feet.
Three green and two white lights, 31¼ feet.
Four green and two white lights, 32 feet.
Three white lights, 32¾ feet.
One green and three white lights, 33¼ feet.
Two green and three white lights, 34 feet.
Three green and three white lights, 34½ feet.
Four green and three white lights, 35 feet.
Four white lights, 35¾ feet.
One green and four white lights, 36½ feet.
Two green and four white lights, 37¼ feet.
Three green and four white lights, 38 feet.
Four green and four white lights, 38½ feet.

By day the depth in the channel is shown by means of cones (point up) and balls in lieu of the green and white lights, respectively.

A blue flag indicates that there is 4 inches more water than shown by the signal.

A white flag with a black St. George cross indicates that it is high water.

A blue pennant indicates that it is low water.

A white flag with a black St. George cross over a blue pennant indicates that the tide is falling, and the same flag hoisted under a blue pennant indicates that the tide is rising.

The Amsterdam North Sea Ship Canal.—The trade of Amsterdam having been greatly on the decline led to the construction of this canal, which was opened on November 1, 1876, thus joining Amsterdam with the North Sea by a more direct and shorter communication than that through the Great North Holland Canal, which is nearly 50 miles in length and involves navigating the channels between the shoals at the Texel leading to its entrance at Nieuwe Diep, whereas the Amsterdam North Sea Ship Canal is only 15 miles in length and 13½ miles from its entrance at Ymuiden to Amsterdam. A branch canal with a depth of 29½ feet, connects the North Sea Canal with the port of Zaandam, about 3½ miles northwestward of Amsterdam. The canal has been widened and deepened and is lighted throughout by incandescent electric lamps, placed mostly in pairs opposite each other, at distances of 262 yards and at shorter distances along curves and near the locks.

The entrances of the various side or branch canals are indicated by colored lights, green being kept to starboard on entering and red to port.

Vessels may now enter the locks at Ymuiden and proceed to Amsterdam, or return therefrom, at any hour of the day or night. The passage through the locks and canal occupies about three hours.

The maximum breadth of vessels passing through the locks at Ymuiden must not exceed 78½ feet nor the length 720 feet.

The bill for the construction of new locks from Ymuiden to Amsterdam has been passed.

The depth of the canal will be increased at first sufficiently to enable vessels of 36 feet to pass through to Amsterdam, and subsequently for heavier drafts.

The new locks at Ymuiden will be 984 feet long, 131 feet wide, and the depth will be 43 feet at ordinary low water and 48¼ feet at ordinary high water.

There are no canal, lock, or light dues.

Dimensions—Depths.—The canal is entered from Ymuiden Harbor by locks. When vessels have passed the locks, the navigation of the canal offers no difficulty and there is no current. The width at the bottom is 164 feet in the straight parts, 196 feet at the bends, and at the surface about 328 feet, increasing considerably in the vicinity of Amsterdam. A maximum depth of 34 feet is maintained and there is deeper water in the channel off Amsterdam.

Vessels of 30 feet draft are allowed on the canal when the water therein is at canal gauge, or 1⅔ feet below Amsterdam mean water level. The draft in the canal is stated to be about 4 inches more than outside the locks.

Railway bridges.—There are two revolving railway bridges over the canal—namely, one at Velzen and one at Zaandam; when open they leave a clear passage 180½ feet wide. The bridges are opened in a few seconds, but are kept closed for 15 minutes previous to the train crossing. Tide gauges are placed on each side of the Zaandam Bridge, adjusted so that the distance from the underside of the bridge to the surface of the water may be read off. Vessels which are not at all higher than 35 feet + N. A. P. (N. A. P. is the mean water level at Amsterdam) can pass under the closed bridge.

The passage between the pillars of the old bridge at Zaandam is 131 feet wide, and until they have been removed will be indicated by day by stakes placed in the canal, and at night by a green light on each pillar. Two vessels can pass each other between the pillars.

Directions have been given for entering Ymuiden Harbor; no further directions are necessary for entering the canal, as the vessel will be in charge of a pilot.

Speed limits.—The speed at which steamers may proceed in the canal is regulated according to their draft.

Vessels with a draft of more than 19½ feet must not exceed a speed of 5⅓ knots; those between 19½ and 13 feet, of 6½ knots; and those of less than 13 feet, of 8 knots. Vessels in tow, by day, must not exceed a speed of 4¾ knots, and by night 3¼ knots.

Locks.—Lock A, the new and northern one, is 738 feet in length, 82 feet in breadth, with a depth on sill of 29¾ feet at low water. This lock can be divided by inner gates, when necessary, into two compartments, 492 feet and 246 feet in length, respectively, the eastern compartment being the longer.

Lock A is worked by electricity.

Vessels 721¾ feet in length and 78¾ feet beam can be passed through Lock A.

Lock B is 390 feet in length, 59 feet in breadth, with 23 feet on its sill. This lock can be divided by inner gates, when required, into two compartments of 228 and 162 feet, respectively, the western being the longer.

Lock C is 226 feet in length, 39 feet in breadth, with a depth of 13¾ feet on sill.

In August, 1908, the depth from the sea to the new lock was not less than 31 feet at low water. A depth of 25 feet can be reckoned on up to the entrance of the old locks.

The canal also connects Amsterdam with the Zuider Zee by the Orange Locks, for the use of the numerous small craft and fishing vessels sailing between Amsterdam and the different towns on the shore of the Zuider Zee.

The three locks, from 46 to 59 feet wide, and with 14¾ feet on the sill, are situated near the village of Schellingwoude, and are deep enough to receive any vessel that can cross the bar of the Pampus, which has a low water depth of 9 feet water over it.

The number of vessels passing through the Orange Locks averages 67,000 annually.

There is a pumping station near the Orange Locks for the regulation of the level of the water in the canal and for other purposes.

Ice breakers are employed in the winter, when necessary, to keep the navigation of the canal open; but while large vessels may be able to pass through the daily steamship service to the Zuider Zee is sometimes interrupted. In the severe weather of 1890–91 it was closed a few days before the end of the year to January 26 following.

Canal regulations.—Every commander of a vessel navigating the canal or using the harbors must be provided with a copy of the "Canal Regulations," and shall, on demand, produce it to the canal officials.

Lights, canal.—In addition to the lights in the canal approach are the following: Electric fixed range lights are exhibited from iron supports on the north side of the approach to Lock A. The front one is green and the rear one red; when in line 69° they lead in the fairway toward that lock.

An additional pair of electric fixed range lights, the front (eastern) one green and the rear (western) one red, have been established on the northern side of the harbor to the eastward of the fort. They are exhibited from green square iron frameworks 434 yards apart.

These lights in line astern, bearing 269° lead from the alignment of the range lights, situated near the entrance to Lock A, directly up to the entrance to that lock.

A flashing light, showing white, red, or green, is exhibited from a green square iron framework on the seaward end of the tongue dividing Lock A from Lock B.

The light is changed to red when a vessel approaching the locks is required to take Lock B or C, and to green for Lock A. When the light shows white large vessels only may approach Lock A. In coming down the canal, a similar light on the eastern end of the tongue will show red for Lock A, green for Lock B or C, and white as above. The rule is red to red and green to green with regard to the vessel's light and the flashing light.

Green electric lights are exhibited on both sides of the lock gates when access is safe. A red light will be shown instead of each pair of green lights when access is unsafe. The sides of Lock A are lighted by incandescent electric lights.

Sluice signals.—Whenever two of the sluices are open in the locks at Ymuiden, two blue flags with the word "Spuien" in white letters will be hoisted at the flagstaff near the western range light into the harbor during the day, and at night two groups of lights, each group comprising three red lights triangularly placed, apex uppermost, will be exhibited at the yardarm of the semaphore signal staff.

If only one sluice is open, the signals will be of the same character and hoisted in the same positions as those above described, except that by day only one flag will be hoisted, and by night only one group of three red lights triangularly placed.

The signals will be hoisted at least one hour before the sluices are opened.

Vessels, provided that they are of over 21 feet draft, desiring to have the sluices closed or partially so, can make signal to this effect by hoisting letter N of the International Signal Code by day, or three red lights, vertically placed, at night.

If this request can be complied with it will be answered in the following manner: If only one sluice is open, the signal indicating it will be hauled down; if two sluices are open, one of the two signals indicating it will be hauled down.

Should it be impracticable to close the sluices, the signals indicating that they are open will be kept displayed.

Traffic regulations.—To obviate the inconvenience of vessels passing each other in the narrow part of the approach to the canal the following signals are exhibited from a signal mast near the semaphore at the front lighthouse:

The day signals are made by two signal arms directed in a north and south direction, that pointing north being painted white on the sea side and red on the land side and that pointing south red on the sea side and white on the land side. When not in use both arms hang vertically downward.

The night signals are made by red electric lamps horizontally arranged.

Signal.	Indication.
By day: Arm pointing north. By night: Two red lights showing landward.	An incoming vessel approaching. No outgoing vessel leaves.
By day: Arm pointing south. By night: Two red lights showing seaward.	A vessel leaving the canal. No incoming vessel approaches.
By day: Both arms extended. By night: Two red lights showing seaward and two red lights showing landward.	An incoming vessel may approach or an outgoing vessel depart.

When a red hemispherical cylinder is hoisted by day or a red light shown at night, an approaching vessel must anchor at 100 yards from the lock.

Canal signals.—A cross arm on the light post at the west end of the tongue, between the locks, points to the lock, north or south, that a vessel is to enter the canal by.

By night red or green flashes from the light on the same light post instead of the usual white flashes; green for entering the northern or Lock A (the new one) and red for Lock B, the reverse on leaving, shown on east end of tongue, as mentioned with the lights.

If the cross arm by day be not shown and the flashing light remains white, vessels of greater length than 328 feet, or with a draft in excess of 19½ feet, must pass through Lock A.

In the canal the signal that a bridge will be opened after the passing of a train is—by day, the signal ball above the bridge will be lowered halfway and immediately hoisted again; by night, the red light (signal that the passage through is closed) will be shown three times successively as red, green, red.

Amsterdam, the most important commercial city of Holland, is at the confluence of the Amstel and the Y, an arm of the Zuider Zee. It is the largest town in Holland and constitutionally its capital. The sea front of the city forms a nearly direct line of 1½ miles in length along the Y, flanked at either end by docks, and intersected near the center by the Dam Rak, the principal outlet of the Amstel. Amsterdam may also be approached from the Zuider Zee, but the depth is only about 9 feet over the flats.

The city is cut up into 90 islands by the canals, in which vessels are to be seen passing to and fro or loading or unloading in all parts of the city.

Population is about 590,000.

The United States is represented by a consul and a vice and deputy consul.

The dock and quay accommodations at Amsterdam are sufficient for a very large trade. The Commercial, Y, and Ore Quays are 6,562 feet, 3,609 feet, and 1,050 feet in length, respectively. These are connected with the railway which passes along the dike fronting the city. The dock and quay dues are moderate, and the North Sea Canal is an entirely free waterway.

Depths.—The Commercial Quay has a depth of 26¾ feet alongside, the Ertskade or Ore Quay 29½ feet, and the Y Quay 29½ feet.

Tidal signals.—(See Ymuiden tidal signals.)

Wet docks.—The Entrepothaven, on the southeast side of the city, is about 28 acres in area, 5,036 feet in length, 300 feet in breadth, and has a depth of 28 feet of water. It is entered by gates.

The channel leading to it from the canal is 164 feet wide, with a depth of 29½ feet.

The Petroleum Basin is also 35 acres, with 26 to 28 feet of water; Spoorweghaven has 23 feet and Houthaven has 26 to 28 feet of water.

The east dock has an area of 37 acres, a depth of 19½ feet, with 19 feet on the sill. It is proposed to widen and deepen the approach to this basin. None of the docks are affected by the tides, being connected with the sea by the canal. There are fixed cranes up to 80 tons and floating cranes up to 20 tons.

The Wilhelmina Floating Dock is 424 feet in length, 73½ feet wide, with 20 feet of water on blocks, and a lifting power of 7,500 tons.

The Koning and Koninginne are each about 400 feet in length, with depths of 18 and 17 feet, respectively, on their sills. The largest vessel docked in the Koninginne Dock was 4,444 tons and 360 feet long by 47 feet beam.

The channel in the harbor of Amsterdam is marked by several light buoys and a beacon showing occulting and flashing lights. (See Appendix.)

Dockyard.—The Netherlands Government Dockyard here builds vessels for the Navy. Near it are several yards supplied with all necessaries for repairing vessels or their engines and boilers. There is a floating crane capable of lifting 80 tons.

Trade.—The principal exports (before the beginning of the war) consist of butter, margarine, cheese, refined sugar, flax, cattle, sheep, madder, geneva, etc.; and the principal imports, coal, sugar, coffee, hemp, grain, rice, pepper, linseed, tea, cotton, wool, hides, tobacco, iron and iron manufactures, etc.

Communication.—Amsterdam is in telegraphic communication with all parts of the world. Railways connect it with all the first cities and towns of Holland and the Continent rivers and canals form a means of communicating with other parts of Holland, parts of Germany, Austria, and Belgium.

Coal and supplies.—About 6,000 tons of English coal are usually in stock. Welch coal is not kept for supplying shipping. Patent fuel is not kept in stock, but is obtainable at short notice. Liquid fuel can be obtained.

Coal can be loaded direct from the railway wagon at the municipal coal tip, where large vessels can lie in 28 feet of water.

Stores of every description for shipping are to be purchased.

Sailors' home.—There is a sailors' home, where seamen can be boarded and lodged.

Hospitals.—There are two hospitals at Amsterdam which receive foreign seamen.

Time signal.—A time signal is erected on the public buildings, Commercial Quay, at Amsterdam. The signal apparatus is 101 feet above the ground and consists of four black disks of latticework.

The signal is made once daily, as follows: The disks are placed in a vertical position five minutes before signal and fall into a horizontal position at noon, equivalent to 23 h. 40 m. 28 s. Greenwich mean time.

Recent investigations place the meridian of Amsterdam (west tower of Wester Kirk) in 4° 53′ 1.5″ east of Greenwich.

Off-lying banks—Brown Ridge.—On the eastern side of the fairway of the North Sea, nearly on the parallel of Ymuiden, and on the meridian of 3° 20′ E., is the south end of a narrow ridge, which extends to the northward for upward of 20 miles; about 10 miles to the eastward is another ridge, and between them a third, with general depths of from 11 to 15 fathoms, and with deeper water between them. These depths may be a guide to seamen when in this vicinity.

The Broad Fourteens is the space between the Brown Ridge and the coast between Ymuiden and the Texel. A wreck is charted in its northern part in the Texel Approach about 12 miles southward of th Haaks Light Vessel, and there are several between it and seaward of the Terschelling Light Vessel.

A reported bank, with depths of from 9 to 11 fathoms, sandy bottom, is charted about 25 miles 324° from the Haaks Light Vessel.

Coast.—Wijk aan Zee, 2 miles northward of Ymuiden, is distinguished by a sand hill, with a summer house on it higher than the coast about it. The tower of Wijk aan Zee Church shows over a gap in the downs when abreast. The church of Beverwijk, 3 miles inland, has a tower with a spire, and farther northward, at nearly the same distance from the coast, the church towers of Heemskerk and Kastricum.

Egmond aan Zee is situated about 9 miles northward of Ymuiden. The church has a spire. Its red lighthouse sometimes shows very indistinctly against the white sand hills in the background.

Egmond aan Zee Light.—A fixed red light, at an elevation of 120 feet above the sea, visible seaward 8 miles, is shown from a red circular stone tower, 92 feet high, on a sand hill north of the village.

At Kamperduin (Camperdown), about 5 to 6 miles northward of Egmond aan Zee, the downs are higher than those on either side, and they may be seen 20 miles in clear weather. These sand hills, named Camperdowns or Schoorldowns, appear of darker color than the hills on other parts of the coast, as more vegetation grows on them, but Kamperduin is bare and steep on the west side.

Petten.—Between the Camperdowns and Petten Village is a break in the line of sand hills, and the land is here protected from the sea by Hondsbossche Zeewering Dike. Petten Church with a spire, and having some houses and windmills a short distance southward of it, stands where there is a wide gap in the downs. Close to Petten is a sand hill, upon which will be seen, when abreast of it, a building resembling a lighthouse. The courthouse, south of Petten, is a conspicuous mark.

Bank.—Petten Polder, a bank abreast Petten Village, which formerly had but 12 feet of water, has now nowhere less than 19 feet. A red nun buoy with upright cross, and marked "Petten," is moored in 5 fathoms on the western edge of the bank.

Kallantsoog is seen through a wide opening in the downs. The steeple of its church in line with the southern slope of the hand hills to the northward of the village, serves as a mark to vessels rounding the Haaks Banks.

Signal-and life-saving stations.—There is a lifeboat at Wijk aan Zee; lifeboat, telegraph signal, and day and night storm signal stations at Egmond aan Zee; a day storm signal station at Kamperduin; lifeboat and telegraph stations at Petten and Kallantsoog; a day storm signal station at Zanddijk; a telegraph signal station at Kykduin; a lifeboat at Huisduinen; a storm signal station at the Helder, and a lifeboat, telegraph, and storm signal station at Nieuwe Diep (Willemsoord). in the Texel.

Texel Approach—Aspect.—About 2 miles northward of Kallantsoog is a high sand hill named Dubbelduin, and 1 mile farther on are two light beacons on the Zanddijk Range of sand hills, named the Groote Kaap and Kleine Kaap (great and little beacons), used for clearing the Haaks Banks. The Groote Kaap, 64 feet above high water, has a round head, and the Kleine Kaap, 36 feet high, a square head. Two conspicuous sand hills, a little to the northward of the Kaaps, are named the Bollen. Kykduin Lighthouse stands at the northern extremity of the Zanddijk, a range of sand hills in continuation of the Bollen. A gray house about 1¾ miles north of Zanddijk Lighthouse is quite conspicuous.

Close to the sand hill on which Kykduin Lighthouse stands are the Schouten Kaap and Kleine Kaap Beacons and the steeple of Huisduinen with a large water tower with flagstaff about 1.3 miles to the eastward of it. Beyond these is the opening of the Texel, the south shore of which is lined with the houses forming Helder Village, and the royal dockyard at Willemsoord, Nieuwe Diep. On approaching the coast near Kykduin with the lighthouse in sight, but before the sand hills come in sight, the masts of the shipping in Nieuwe Diep, with the churches, masting sheers, and crane at Willemsoord, will appear; on nearer approach, the meteorological observatory and the tower of the town hall at De Helder, the fort on the highest sand hill, with the low receding land to the northward breaking off at Texel Gat, are easily distinguished.

Tidal currents between Ymuiden and the Texel.—From Ymuiden northward to a position 8 or 10 miles from Kykduin Lighthouse, outside the influence of the channels through the Haaks, the flood current or northern tide during the first five hours sets northeast by north and for a part of the sixth or last hour northeast by east. When near about high water, it trends to the east by north and east by south, and after continuing for a while in the latter direction it goes around to southeast by east until high water. The ebb current sets south the first hour, veers around during the next four hours to southwest by south and so to west by south and to the northward during the last hour, attaining a northeast by north direction by the time the flood makes. Along the whole of this coast the tidal current set six hours each way, but it is only during the first three hours of the flood stream that any rise is perceptible on the shore, the falling of the water lasting during nine hours. On full and change days the flood begins at noon, and by 3 o'clock the tide has attained its maximum height between Scheveningen and Petten.

The following table shows the set of the currents at the Haaks Light Vessel with regard to high and low water at Dover. It is high water at the Texel some five hours before Dover.

Time of tide at Dover.	Haaks Light Vessel.		Time of tide at Dover.	Haaks Light Vessel.	
	Direction.	Velocity.		Direction.	Velocity.
		Knots.			*Knots.*
5 hours before high water......	NE. by N.	½ to 1½	1 hour after high water.......	SW. by S.	½ to 1¼
4 hours before high water......	E. by N.	0 to ¾	2 hours after high water......	W. by S.	0 to ¾
3 hours before high water......	S. by E.	0 to ¾	3 hours after high water......	N. by W.	0 to ¾
2 hours before high water......	S. by W.	½ to 1½	4 hours after high water......	N. by E.	½ to 1½
1 hour before high water.......	S. by W.	¾ to 1½	5 hours after high water......	N. by E.	1 to 2¼
High water at Dover..........	SSW.	¾ to 1¼	6 hours after high water......	NNE.	¾ to 2¼

H. O. Charts 5213 to 5224, inclusive, contain information of currents in this vicinity.

Haaks Light Vessel.—About 15 miles westward of the entrance to the Texel and nearly 10 miles westward of the outer edge of the Haaks Banks is the Haaks Light Vessel, moored in 16 fathoms, with Zanddijk Front Lighthouse bearing 108° 30′, distant 15½ miles and nearly in line with the rear light.

From the masthead, at an elevation of 36 feet above the sea (in bad weather 30 feet), is exhibited a flashing white light, visible 11 miles. A white riding light is shown from the forestay.

The light vessel, with one mast and a jigger mast, is painted red, with the name, "Haaks" in black letters on the sides, and carries a red cone, point downward, at the masthead as a daymark.

When from any cause the flashing light can not be exhibited, a fixed white lantern light will be shown from the mast head and a red flare-up every 10 minutes from above the gunwale. If this vessel has drifted, the usual lights will not be exhibited, but a fixed red light will be shown from each end of the vessel. By day a red flag will be hoisted above the red cone at the masthead. Should a vessel be seen standing into danger, a gun will be fired, and repeated if necessary; also the signal flags J D of the International Code, signifying "You are standing into danger," will be hoisted and kept flying until answered. A bright rocket immediately after a gun will indicate that assistance from the shore is required.

Watch buoys.—To mark the position should the light vessel get adrift, two watch buoys, both painted red with a white horizontal stripe and with "H No. 1" and "H No. 2" on them, respectively, in black letters, are moored north and south of each other and ½ mile apart at about the same distance westward of the light vessel.

The vessel is liable to be removed from her station for short intervals for repairs without notice.

Fog signals.—During thick or foggy weather a siren is sounded. Should the siren be disabled, a bell and a hand foghorn will be sounded alternately.

A submarine fog bell is operated during thick or foggy weather.

Radio.—A radio apparatus has been installed on board the Haaks Light Vessel. The call letters are H K S.

Vessels are not permitted to communicate with the light vessel by means of radio excepting in case of necessity, but messages will be received from passing vessels by International Code and telegraphed to the shore, and ships signaling their names by the same code will be reported telegraphically to their owners.

Messages can be sent from the shore to the light vessel for transmission to passing vessels by International Code.

Storm signals, in accordance with the Netherlands system, are shown from the light vessel.

Texel, or Texel Gat, upward of 2 miles wide, is the important passage between the Helder and Texel Island and connects the North Sea with the Zuider Zee, the Nieuwe Diep, and the Great North Holland Canal, leading to Amsterdam.

Aspect.—The land bordering the gat, which embraces from Kallantsoog to the Helder, has been described. The southwest and northwest sides of Texel Island are formed by sand hills like the coast to the southward. In the southwest part of the island are the villages of De Hoorn and Westen. The church tower of the latter, square and bluff, can be seen from sea only occasionally and in clear weather; that of De Hoorn has a spire and stands farther southward. Upon the southwest shore are two sand dunes, rendered remarkable by the deep score between them; one is named the Heuvel, and the southern and larger Pietersduin; and these, with the aforenamed churches, form important marks in the navigation of the channels of the Texel.

Depths in the entrances.—The principal channel into the Texel is the eastern one, the Schulpen Gat, situated between the Fransche Bank fronting the south shore and the South Haaks Banks. It has a depth of 4¾ fathoms on the line of the range lights and fairway buoy, but on the bar at the northeast end of the channel there is a depth of about 27 feet in the passage across, and a least depth of 18 feet elsewhere. Northward of this bar the water is deep.

West Gat is between the South and North Haaks. There is a depth of about 15 feet in mid-channel with slightly deeper water toward the can buoy side.

Molen Gat lies between these banks and Texel Island, off which is the Onrust Sand, nearly 1 mile in extent. The gat has a depth of about 13 feet at low-water springs, the best water being on the can buoy side. The depths in all these channels are subject to considerable change.

Off the southwest end of Texel Island the foreshore dries out about 1 mile, but on the opposite side of the gat the water is deep close-to.

Pilots.—Two coast pilot vessels, painted black and yawl rigged, cruise at a distance of 4 to 8 miles from the fairway buoy, one between Egmond aan Zee and the Schulpen Gat, and the other off the West Gat. A pilot schooner cruises off Dungeness.

These vessels have the words "Texel en Ymuiden" and their number painted on the mainsail in black. The number is also in white on the stern. By day they carry a blue flag at the masthead with the vessel's number on it in white; also at the mizzen the distinguishing flag, black and white vertically striped, with the Netherlands colors in the corner. At night a white light is hoisted and a flare-up shown every 15 minutes.

Signals for tugs.—There are tugs at Nieuwe Diep, which may be obtained by vessels in the offing showing two flags, one at the masthead, the other 4 or 5 feet below it. This signal may be made as soon as Kykduin Lighthouse is well in sight, from whence it will be repeated by a ball. The lowering of the ball is a signal that the steamer is on the way out; but should a red flag be hoisted it denotes that the desired assistance can not be rendered.

Signal and life-saving stations.—There is a refuge beacon on Onrust Sand in the mouth of the Texel. At De Koog, west side of Texel Island, there are lifeboat, telegraph, and day storm-signal stations. De Burg, near the center of the island, is a telegraph station, and De Hoorn is a lifeboat station, and there is a storm-signal station at Oude Schild on the inner side of the island, also one (day) at the north end.

Banks—Haaks Banks.—The approach to the Texel from the North Sea is obstructed by shallow sand banks, dry in places, which, comprised under the general application of the Haaks, form a barrier across the entrance and extend about 5½ miles offshore, in the shape of a horseshoe with navigable channels or gats through them.

On their west side the Haaks fall almost perpendicularly into a depth of 10 fathoms; their surface is subject to frequent alteration, and these features are rendered the more dangerous (modified by the buoyage) on account of the distance to which the sands lie out from a low coast of great uniformity of appearance.

The Zuider Haaks comprise the Bollen, Wagenpad, and the Boter Rug, and the Noorder Haaks, the Keizers Bult, and the Razende Bol.

The wreck of the steamship *Ninian Paton*, situated on the Noorder Haaks, about 2 miles northward of the bar of the West Gat, has two masts and a funnel showing above high water. The wreck is conspicuous and may be useful for vessels making West Gat or Schulpen Gat from the northward in hazy weather.

Onrust.—A bank extends 1½ miles southwestward of Texel Island, on the extremity of which is Onrust Sand Bank with a refuge beacon. This bank forms the eastern side of the Molen Gat, and northward of the bank is a boat channel named the Noorder Gat.

Buoyage.—The seaward edge of the Haaks Banks is marked by five buoys, as charted, but the positions of these, as well as of those marking the gats, are subject to change and must not be implicitly relied on.

Schulpen Gat outer and fairway buoy, in 5½ fathoms, is a black and red vertically striped buoy, model hourglass, surmounted by an upright cross. It lies with Kykduin and Schulpen Gat Lights nearly in line and Zanddijk Lights in line.

Zuider Haaks, in 8 fathoms, is a red and white horizontally striped nun buoy with a half ball at topmark, situated about 1 mile off the 3-fathom curve of South Haaks Bank, with the Zanddijk Lights in line.

West Gat is a red and black vertically striped conical buoy marked "W.," with diagonal cross as topmark in 10 fathoms, 800 yards off the 3-fathom curve of the Haaks and about 1,000 yards west of No. 1 black buoy of West Gat.

Middel Rug, in about 11 fathoms, is a red nun buoy with two balls as a topmark, about 600 yards off the Keizers Bult on North Haaks Bank.

Haaks, in about 15 fathoms, is a white conical buoy surmounted by a black flag, in (approximately) latitude 52° 58′ 42″ N., longitude 4° 33′ 57″ E.

Noorder or North Haaks is a nun buoy, painted black and white in vertical stripes with a ball topmark, and is located on the northern edge of Noorder Haaks, in (approximately) latitude 53° 00′ 00″ N., longitude 4° 37′ 20″ E.

Molen Gat fairway buoy is conical, checkered black and white, marked "M.," in red, and is surmounted by an upright cross. It lies outside the entrance to the gat, in about 4 fathoms of water, nearly on the line of the range lights.

The buoys marking the channels or gats are red conical on the starboard hand and black can on the port hand on entering. Some of them have topmarks.

A light buoy, No. 7, painted red and black in horizontal bands, is moored in the West Gat, and exhibits an occulting red light.

A black light buoy, showing a fixed red light, is moored in Texelstroom, about 1¾ miles southward of Oude Schild. Passing between this buoy and conical buoy No. 1a is prohibited.

Wreck Buoy.—The wreck of the steamer *Batavia II* lies sunk on the eastern side of the entrance to the Molen Gat. A green buoy marks the wreck.

Refuge beacon.—A wooden refuge beacon stands on the eastern part of Onrust Sands; it is liable to be washed away.

Zanddijk Lights are situated at the entrance of Schulpen Gat, and 5 miles southward of the entrance to the Texel. The western light is occulting white, exhibited, at a height of 49 feet, from a brown square framework with a gray dwelling. The eastern light is fixed white, exhibited, at a height of 99 feet, from a brown hexagonal framework with a gray dwelling. These lights are both visible 9 miles, and are 110° 400 yards apart; they lead to the entrance of the Schulpen Gat.

Falga Light, occulting, with red and green sectors, situated 2½ miles northward of Zanddijk Light, is exhibited, at a height of 94 feet, from a brown square framework with gray dwelling.

Kykduin Light, group flashing white, situated between Kykduin and Erfprins Forts, on the highest part of the downs, is exhibited, at a height of 187 feet, from a brown iron tower; it is visible 20 miles. The lighthouse is a signal and telegraph station.

Molen Gat Light, fixed white, situated on Helder Dyke, 127 yards in front of Kykduin Light, is exhibited, at a height of 59 feet, from a brown post with platform. This light in line with Kykduin Light, bearing 144°, leads through Molen Gat.

Schulpen Gat Light, fixed white, situated 574 yards southwestward of Kykduin Light, is exhibited, at a height of 85 feet, from a brown iron frame. This light, in line with Kykduin Light, bearing 39°, leads through the entrance to Schulpen Gat.

Nieuwe Diep Lights.—A fixed white light is exhibited at a height of 29 feet, from a yellow post, at the extremity of the west pier.

A fixed red light is exhibited, at a height of 34 feet, from a yellow post, 73 yards within the white light.

Schilbolsnol Light, fixed white, visible 13 miles, is exhibited, at a height of 91 feet, from a black square iron frame, on the south side of Texel Island.

Stuifdijk Light, occulting white, visible 10 miles, is exhibited, at a height of 29 feet, from a black square iron lighthouse, 765 yards southward of Schilbolsnol Light. In line with the latter light, 28°, they lead through the northern portion of Schulpen Gat. (See Light List for all lights.)

Ice.—In winter the marking of the fairway is uncertain on account of the buoys being dragged out of position by ice. An ice belt sometimes forms off the coast, preventing vessels from putting to sea, and in worse conditions the communication between Texel and the mainland is effected by means of sledges.

Directions—Texel approach—General remarks.—The steep and dangerous character of the Haaks Banks has already been referred to. It may also be added that though landmarks abound and the land between Kallantsoog and Kykduin, termed the "Zanddijk," will be visible 14 or 16 miles, yet with the least haze no more is to be seen here than on other portions of the Dutch coast under similar circumstances, namely, an indistinct waving line. At such times it is necessary to be extremely cautious, particularly as the currents are very variable both in direction and velocity, and both much affected by strong winds, and the lead gives no warning of the approach to the actual west side of the banks. A vessel should not get into less than 13 fathoms unless one or other of the distinguishing buoys marking the Haaks has been sighted. And as the banks, and consequently the buoyage, are subject to frequent change, strangers should not attempt any of the channels leading to the Texel without the aid of a pilot.

From the southward.—Steamers bound to the Texel should make the Haaks Light Vessel (lat. 52° 58′ N., long. 4° 18′ 7.), whence course may be shaped as requisite for the Schulpen Gat.

Sailing vessels are recommended to make the land about Egmond aan Zee or Kamperduin, as there are situated the best distinguishing marks on the coast. Caution is necessary not to mistake Kamperduin for Kykduin, because between Kamperduin and Petten, or the downs of Kallantsoog, the land is so low that it appears like the entrance to a spacious harbor.

From the northeastward.—The approach to the channels of the Texel from the northeast requires great caution, more particularly in sailing vessels, the course lying along a chain of low islands, having few objects to distinguish them, where the tidal currents are irregular, and where the approach to the land is rendered additionally hazardous by extensive sand banks, which, however, are in normal times well marked by buoys.

By night.—Rounding Texel Island from the northeastward during the night, do not shoal the water under 13 fathoms, so as to avoid the Eierland Grounds and the North Haaks, as the current of flood sets toward them, and they are consequently specially dangerous in thick weather. If the lights of Terschelling and Vlieland have not been sighted, then make the Haaks Light Vessel, and be careful to keep in at least 13 fathoms of water while rounding the Haaks Banks until to the southward of the Texel, or till Zanddijk Lights are in line, for, as before observed, 10 and 11 fathoms exist close to the edge of the sand banks.

Schulpen Gat—Depths—Bar.—Schulpen Gat is the best of the Texel Channels and that generally used. It extends in a northeast direction for about 5 miles close along shore and is direct, but it is subject to alteration, and consequently changes in the buoyage. It has a depth of about 4¾ fathoms over a distance of ½ mile on the line of range lights.

There is a bar across the northeast end with a buoyed channel across it.

The channel across the bar is marked on its eastern side by a red gas buoy showing an occulting white light every 15 seconds, and on the west side by a spherical buoy, painted in red and black horizontal bands, and exhibiting an occulting red light. The depth between the buoys is about 27 feet. The remainder of the bar carries a least depth of 18 feet at low water.

The channel up to the bar is marked by red conical buoys and one light buoy, on the starboard hand, Nos. 2 and 3, with topmark, and black can buoys on the port hand on entering, Nos. 1 and 5, with truncated cone as topmark, with a distinguishing fairway buoy at the entrance near the line of the range lights. No. 4 red buoy shows an occulting white light every 10 seconds (light 7 seconds, eclipse 3 seconds), and lies about 600 yards westward of Schulpen Gat Light.

On the formation of ice the red light buoys are replaced by red conical buoys.

Tidal currents of the Texel.—Practically the tide stands at high water for about three and one-half hours at the Texel, and there is a difference in the time of high water between it and Ymuiden, only about 30 miles from it, of about three hours.

Near the mouths of the channels the latter part of the ebb current trends to the northwest, and at the same period of the flood the current runs southeastward; this last portion of the flood, which is called the land tide, causes the water in the channels, the height of which had for a while been stationary, to rise about 4 inches more.

In Schulpen Gat the current sets generally in the direction of the channel, but from the entrance to as far as Falga, both flood and ebb rather incline toward the side of the Haaks, and at the inner part of the channel somewhat toward the red buoys. There is but little slack, and both tides run six hours, except during strong winds.

During the prevalence of gales from northwest or southwest the flood may run eight hours and the ebb only four hours. At such times the ebb current is weak, while that of the flood acquires an increased velocity. When the ebb current is increased by a freshet, its course along the sea wall of the Helder is rapid.

Directions for the approach to the Texel have been given.

Approaching Schulpen Gat from the offing, near the Haaks Light Vessel, the Zanddijk Range Lights in line 110° lead westward and 1,350 yards southwestward of the 3-fathom edge of the South Haaks and to the South Haaks Buoy and the fairway buoy. The tidal current at times sets across the entrance and must be guarded against.

From the southward, Kykduin Lighthouse in line with Schulpen Gat Lighthouse below it, bearing 39°, leads to the fairway buoy, which line, being continued, will lead between the red and black buoys marking the channel. When abreast No. 2a red buoy, where Falga Light changes from green to red, steer for Schilbolsnol and Stuifdijk Lights on the south part of Texel Island, in line, bearing 28°, which will lead toward the bar. When past No. 4 light buoy, a red buoy showing an occulting white light, steer more to the northward to pass close to No. 7 light buoy, showing an occulting red light.

Within the bar are the Helsdeur, Marsdiep Texelstroom, and the Malzwin, where the water is deep.

Caution.—Should the Schulpen Gat be passed through at the beginning of the flood, the ebb current which has not ceased running at its northern end will be found sweeping with full force from the Texel past the Helder Dyke toward West Gat, and if the wind be too light to enable a sailing vessel to make head against the current, she should anchor at once to prevent being driven down the Breewijd.

West Gat has a depth of about 15 feet at low water, subject to change. The entrance to the gat (1908) was situated on the line of the Roman Catholic Church in line with Kykduin Lighthouse 71° and which being steered for led between Nos. 1 red and black buoys and over the bar; thence about 65° between the buoys into the Breewijd or Broadway, where the water is deep, and into the Texel.

Molen Gat had about 13 feet at low water in the buoyed channel in 1909.

Kykduin and Molen Gat Lights, in line 144°, lead close past the fairway buoy and into the entrance, whence the black buoys should be kept on the port hand, there being only one red buoy, which is in the northern entrance. The southernmost buoy on the east side of the channel, off the south point of Onrust, is a black light buoy showing an occulting white light every 10 seconds—thus: light 7 seconds, eclipse 3 seconds. On the formation of ice in the locality it will be replaced by a black spherical buoy with diamond topmark.

These gats require a pilot for reasons before given.

Helsdeur Road, or Texel Road, is off and westward of Willemsoord, with depths of 10 to 15 fathoms. The ground, a soft clay, is indifferent holding ground. Westerly winds send a heavy swell in and the anchorage should only be used for a temporary purpose by vessels bound up the Zuider Zee. If bound into Nieuwe Diep, the best plan is to enter it at once, if a pilot is on board. The seaman is referred to the chart for information above Willemsoord.

Helder and Willemsoord.—De Helder is a strongly fortified military post commanding the channel into the Zuider Zee as well as Willemsoord. It is connected by rail with Amsterdam but has very little trade.

Dockyard.—Nieuwe Diep, on the west side of the entrance to which is Willemsoord, a royal dockyard, is the outlet of the Great North Holland Canal, and has been made to serve the purpose of a harbor as well as a dockyard. It is rather more than 1 mile in length and its depth admits of vessels using the canal passing through at all times. The greatest length of any vessel which can enter the inner harbor is 218 feet and the greatest draft 18¾ feet. It is forbidden to enter or leave the harbor when a blue flag by day or a green light at night is shown from the Wierkoofd and near the harbor office.

Time signal.—Four black disks on the roof of the chief office of the marine establishment at Willemsoord, 57 feet above the ground, are placed perpendicularly at five minutes before signal, and fall into a horizontal position at noon, Amsterdam mean time, equivalent to 23 h. 40 m. 28 s. Greenwich mean time.

Docks.—There are two docks at the royal dockyard of Willemsoord. The larger is 361 feet in length on the blocks, 64 feet wide at the entrance, and has 18 feet on the sill at high water. (See Appendix.)

Measured distances, for testing the speed of vessels, have been established in the Texel. The beacons consist of iron posts carrying a square disk, painted vertically, half white and half black.

One measured distance of 3,031 feet is situated on the southeast side of Texel Island near De Hoorn.

The course to be steered, 49° or 229°, is marked by two can buoys, one abreast each pair of beacons. The western buoy is No. 12, and is surmounted by a truncated cone. The eastern buoy is unnumbered and is surmounted by a diagonal cross.

The other measured distance of 3,441 feet is situated on the southern shore of Helsdeur Road, immediately to the eastward of Kaap Hoofd.

The course to be steered, 74° or 254°, is marked, when trials are to take place, by two light buoys, one abreast of each pair of beacons.

Great North Holland Canal.—This work, which has its outlet at Willemsoord in Nieuwe Diep, was constructed between the years 1819 and 1825, and enables vessels to pass up to Amsterdam, and thus to avoid the shallow and intricate navigation of the Zuider Zee. This canal is to a great extent superseded by the Amsterdam North Sea Ship Canal and is no longer used by seagoing vessels, but for local traffic only.

The length of the canal is about 50 miles; the width at the surface of the water is from 123 to 197 feet, sufficient to allow of two large vessels passing each other; width at the bottom, 36 feet; and the depth is 18 to 19½ feet. Vessels up to 15¾ feet draft are allowed to pass through the canal.

The canal is divided into three sections, communicating with each other by means of locks; the locks are double—that is, there are two in the breadth of the canal. The larger lock at Willemsluizen is 358 feet long and 59 feet wide, with a depth of 24½ feet; that at Purmerend is 213 feet long, 49 feet wide, with a depth of 22 feet; that at Zijperschutsluis is 380 feet long by 49 feet wide, with a depth of 21⅓ feet.

The lock at Koopvaardersschutsluis, by means of which vessels pass out from the third section of the canal to Nieuwe Diep, Willemsoord, is 226 feet long and 52½ feet wide, with a depth of 21 feet; longer ships must await a "free lock."

The canal is crossed by three double-turning bridges, situated, respectively, at Buiksloot, Purmerend, and Alkmaar, also by several floating bridges. The railway also crosses the canal by swing bridges at Du Kooi, Alkmaar, and Purmerend.

Pilots.—There are canal pilots, and no vessel drawing more than 11½ feet is allowed to pass through the canal without one on board. These men are provided with copies of the canal regulations in French, English, and German.

The Zuider Zee.—The passage to Amsterdam through the Texelstroom and Zuider Zee is only to be undertaken with the aid of a pilot and in small vessels, for though the Texelstroom is deep and navigable by large vessels the Zuider Zee is full of shallows, and only vessels of about 9 feet draft are able to cross the flats to reach Amsterdam by this route, and the chart is a better guide than any written description, though no stranger should enter or navigate it without a pilot. The deep channel to Amsterdam is via Ymuiden.

The Texelstroom also leads through the northern part of the Zuider Zee by the shallow channels named Doove Balg, Zuidoostrak, Inschot, and Vliestroom to Terschelling, and to Harlingen and other places in the sea.

Other entrances to the Zuider Zee are the Engelschman Gat, the Stortemelk (the best and shortest route to Harlingen, the principal port in the sea), and the West Gat. These are described in their proper rotation.

Ports.—Excluding Amsterdam at the southwest corner of the sea, Harlingen at the northern end is the principal place of trade; also on the eastern side are Stavoren, Kampen, Elburg, and Harderwijk; Naarden is on the south side eastward of Amsterdam, while Monnikendam, Hoorn, Enkhuizen, and Medemblik are on the western shore northward of Amsterdam.

CHAPTER V.

FROM THE TEXEL TO THE WESER RIVER.

Note.—The matter in this and other chapters dealing with the German coast and navigable waters, particularly descriptions, locations, and references to aids to navigation, may be erroneous in some instances, because of changes due to war and lack of available information; but navigation of these waters will be resumed after the war no matter by what nation they may be controlled, and aids that were necessary in the past which may have been removed or changed in position will probably be replaced.

Texel Island—General remarks—Aspect.—Texel Island, the southwesternmost of the group of islands off West Friesland, known as the West Frisian Islands, has a general direction northeast and southwest; it is 12 miles in length and 5 miles in width near its middle. Its northeastern part is composed of the former island, Eierland. Considerable numbers of sheep, cattle, and horses are reared upon Texel Island, and De Burg is the market town.

The objects upon the southwest end of Texel Island and its separation from North Holland by Helsdeur and Marsdiep have been noticed in the previous chapter. It is also separated from West Vlieland, or De Horst, to the northward by Engelschman Gat.

Caution.—The islands Texel, Vlieland, and Terschelling, together form a salient point to those proceeding coastwise from the southwestward or northeastward. When rounding them do not approach in less than 13 fathoms water, especially at night. A want of caution is at times displayed in this respect, and much loss has been the result.

Eierland Light.—At the north extremity of Eierland is a red stone tower, with a white band under a black gallery, 112 feet high, from which is exhibited an occulting white light. The light is visible in all directions, except where obscured by the sand hills of Texel and Vlieland, which lie northeast and southwest of the light. It is elevated 165 feet, and is visible 19 miles.

Signal and life-saving stations.—The stations as far north as De Koog have been referred to in the approach to the Texel. In addition to these there is a day storm signal and telegraph signal station at Eierland Lighthouse and a lifeboat and telegraph station at Cocksdorp on the inner side of the island.

Engelschman Gat, the passage between Eierland and West Vlieland, is 1 mile wide and fronted by shallow sand banks to the distance of nearly 2 miles. The channel through the banks is narrow and unbuoyed. It trends in an east-southeast direction northward of Dwars in den Weg Bank toward the western end of Vlieland, and then turns southward in the direction of Cocksdorp. The depth on the outer bar is from 7 to 9 feet at low water, increasing quickly within. The gat is only available for coasting craft with local knowledge.

The channel within is almost choked with the sands, but the narrow swashways are marked by stakes.

Buoy.—A red nun buoy, with white band, marked "E. Gr.," surmounted by a triangle, is moored in a depth of 9 fathoms to mark the edge of the Eierland Shoals, about 4 miles 287° of the beacon on West Vlieland.

Vlieland is about 10 miles in length, east and west, from 1 to 2 miles in breadth, and its eastern end is 5 miles from Terschelling. The island is generally low and sandy, except at its eastern end, where there are a village, lights, and several beacons.

The western part of Vlieland, for a length of 4 miles, is a low, sandy waste, named De Horst, for the most part nearly overflowed at high water, and as this portion of the island is visible but a short distance from the offing a fictitious breadth is thereby given to the opening between Vlieland and the north part of Texel Island.

There is a refuge house on the western extremity of De Horst.

At the east end of the islands, near the lighthouse, there is a conspicuous beacon, named the Strand, and several others useful to the coasting craft.

Vlieland Lights.—On the highest sand hill toward the eastern part of Vlieland, from a brown circular stone tower 55 feet in height, is exhibited, at an elevation of 172 feet above high water, a fixed white light, visible 19 miles. The light appears faint between 313° and 43°.

Vlieland front light (Strandduin), a group occulting light with white, green, and red sectors, situated 321° 1,026 yards from the rear light, is exhibited at an elevation of 92 feet above the sea, from a brown iron framework. (See Light List.)

The Vlieland Lights in line lead rather close to the outer buoy of the Stortemelk.

Signal and life-saving stations.—There is a lifeboat station near the center of Vlieland and another on the northeast end of the island, having also a rocket apparatus.

There is a telegraph signal station at the lighthouse and storm signal station on the same duin, the night signal being only visible inward. A telegraph station is at the post office near the center of the island. A day storm signal station is also near the center of the north coast.

Terschelling Island—General remarks—Beacons.—Terschelling, between Vlieland and Ameland, is 16 miles in length, east and west, and about 2 miles average breadth. It is rather higher than the islands hitherto noticed and many of its higher parts are composed of bare white sand. There are several beacons on the sand hills on its west end for leading into Vliestroom. There are also the two Noord Vaarder Beacons on the sandy tongue forming the west part of the island which is working outward.

The Vaarder Beacons lie nearly 32° and 212° and are 750 yards apart. The northernmost, which is the smaller, has a square head, and the southernmost a diamond-shaped one; both are painted black.

On the duin westward of the lighthouse stand two beacons, 94 yards apart, in a 332° and opposite direction. The northern beacon has a black square topmark facing 302°; the topmark of the southern is shaped like a dovecot; both are 51 feet high.

A beacon stands on the northwest side of Terschelling Island, 15°, about 2 miles from the lighthouse. It is 33 feet in height, with a black square topmark 65 feet above the sea. There are two others on the southeast end of the Bosch, the eastern part of the island. A refuge house for shipwrecked people stands on the north coast of the Bosch, about 2½ miles from the eastern point.

Light and whistle buoy.—The red and white horizontally striped light and whistle buoy moored northward of Noorder Gronden, Terschelling, shows an occulting white light every 10 seconds, thus: light 7 seconds, eclipse 3 seconds.

Villages.—Terschelling has three villages—West Terschelling, Midsland, and Hoorn. The spire of Midsland is a prominent object near the middle of the island, about 3 miles eastward of the lighthouse.

Terschelling Bank Light Vessel is moored in 15 fathoms, nearly on the line of the Vlieland Range Lights, with Terschelling (Brandaris) Light 126°, distant 13.8 miles.

The light is group flashing white, elevated 36 feet above the sea (31 feet in bad weather), and is visible 11 miles. A riding light is also shown.

The light vessel is painted red, with a broad white streak, with "Terschellingerbank" in black letters on the sides, and carries a black ball at the masthead; the vessel has a jigger mast.

In order to mark this position, two watch buoys, painted red, with white band, and the letters (black) T. S. No. 1 and 2 on them, respectively, are placed—No. 1 to the northwest, distant 550 yards. No. 2 to the southwest, distant 550 yards from the moorings of the light vessel.

Note.—This light vessel is liable to be removed for short intervals, without much notice; when repairs are required to the vessel or moorings.

When from any cause the flashing light can not be exhibited, a fixed white lantern light will be shown from the masthead and a white flare every 10 minutes from above the gunwale. When the light vessel is not in station, the usual lights will not be exhibited, but a fixed red light will be shown at each end of the vessel. By day a red flag will be hoisted above the black ball at the masthead.

Should a vessel be seen standing into danger, a gun will be fired, and repeated if necessary; also the signal flags J D of the International Code, signifying "You are standing into danger," will be hoisted and kept flying until answered. A bright rocket immediately after a gun will denote the need of assistance from the shore.

Terschelling Bank Light Vessel has been temporarily withdrawn from its station to mark the free channel through the war zone.

Fog signal.—At Terschelling Bank Light Vessel a siren is sounded. Should the siren be disabled, a bell will be sounded, followed immediately by a hand foghorn.

A submarine fog bell is sounded on board the Terschelling Bank Light Vessel.

Radio.—The light vessel is equipped with radio; call letters P C M.

Currents.—At Terschelling Light Vessel the tidal currents reach a velocity of as much as 2 knots in a northeast by east direction, from five hours to three hours before high water at Dover, and ¾ to 1½ knots southwest by west from one to three hours after high water at Dover. (See H. O. Charts 5213 to 5224 for graphic representation of currents, North Sea.)

Terschelling Light is upon Brandaris Tower, a tall square yellow structure with a flat roof, near West Terschelling, and one of the most distinct objects on the whole coast. It is a flashing white light, exhibited at a height of 178 feet above high water, and may be seen 19 miles.

Stortemelk Range Lights—Front light.—From a brown framework structure with rectangular topmark, 21 feet in height, erected 1 mile northeastward of Vlieland (rear) Lighthouse, is exhibited, at an elevation of 32 feet, an occulting white light.

Rear light.—From a brown framework structure, with square topmark, 44 feet in height, erected ½ mile 131° from the front light, is exhibited, at an elevation of 73 feet, a fixed white light.

These lights in line, bearing 131°, lead into the Stortemelk.

Light buoys.—Nos. 5 and 7 red buoys in the Stortemelk are occulting light gas buoys. In winter they are replaced by conical buoys, each surmounted by a ball, on the formation of ice.

Vliereede Light Vessel, painted black, with two masts and a blue flag hoisted at the fore, is moored in Vlie roadstead. The vessel is named *Uitlegger* (guardship) and exhibits from the foremast two fixed red lights 10 feet apart, horizontally. The lights are elevated 39 feet.

During thick or foggy weather a foghorn is sounded.

If out of position, a red flag will be shown at the fore by day and a red light at each end of the vessel by night.

When withdrawn for ice or other causes a pilot boat will usually be stationed there showing similar lights and flags.

Pilots.—The light vessel is also a pilot station.

Signal and life-saving stations.—Near and at Terschelling Lighthouse are telegraph signal, storm signal, and lifeboat stations. There is a lifeboat and telegraph station at Midsland, a lifeboat and day storm signal station at Oosterend, the inner side of the island, telegraph and signal stations at Koggegronden to the eastward, and a storm signal station at the eastern end of the island.

Stortemelk and Thomas Smit Gats—Depths.—The navigable channel between the sands extending from Vlieland and Terschelling is the Terschelling Gat, the northern entrance to the Zuider Zee, and the shortest and best route to Harlingen.

Banks extend some 6 miles seaward of Boomkens Deep, the name of that portion of the channel immediately between the islands, almost blocking the approach, the Stortemelk and Thomas Smit Gats being simply swashways through them. These have depths of about 19 feet and 11 feet, respectively, at low water over their bars (January, 1909). Springs rise 5 feet.

The Stortemelk leads southward of the Wester and the Stortemelk Gronden, between them and the eastern end of Vlieland. The Thomas Smit Gat leads between the Noordwest and Noorder Gronden.

These gats are subject to considerable change, and the buoyage, therefore, can not be depended on. They are available for light drafts in charge of those locally acquainted with them, and also the Vlie Stroom and other chanels within them leading to the ports in the Zuider Zee.

East or Oost Gat has silted up, but another opening, named Northeast Gat, has about 13 feet in mid-channel, subject to change.

Boomkens Deep, with depths of from 6 to 12 fathoms at low water, connects Thomas Smit Gat with the Vlie Stroom. On its east side, Schuiten Gat, a buoyed channel with a 2¼-fathom bar across its entrance, branches off to West Terschelling.

Buoyage.—The buoyage of these gats is on the uniform system. Only the outer buoys guarding the dangerous and steep-to banks named Noorder Gronden, Noordwest, and Wester Gronden, will be described. For others, see the chart.

A red and black vertically striped buoy, model hourglass, with upright cross, marked "S. M.," is moored about ½ mile southwest of the west end of Noordwest Gronden, in about 5½ fathoms, at about a mile north of the entrance to the Stortemelk.

A black and white horizontally striped conical buoy, with two balls, marked "W. G. T. S.," is moored in 9 fathoms at 1½ miles west of the west end of Noordwest Gronden.

A red conical buoy with diamond topmark, marked "N. W.," is moored off the entrance to Thomas Smit Gat, in 12 fathoms, at about a mile outside the first pair of red and black buoys marking that gat.

Light and whistle buoy.—A red and white horizontally striped light and whistle buoy, exhibiting an occulting white light every 10 seconds, is situated 1 mile north of the north extremity of Noorder Gronden.

A red and white vertically striped conical buoy, with ball, marked "N. O.," is moored in about 6 fathoms off the northeast side of the banks, 94°, 4½ miles from Noorder Gronden light and whistle buoy and about 2 miles offshore. All the buoys are for the purpose of keeping passing vessels outside the shallow banks fronting the entrance westward of Terschelling Island.

These outer buoys are liable to break adrift during stormy weather.

Wreck buoys and wrecks will be observed on the chart in several places.

A red light buoy, showing an occulting white light every 10 seconds, is moored in the entrance to the Schuiten Gat. Vessels drawing less than 10 feet can pass on either side of it. On formation of ice it is replaced by a red conical buoy with ball.

Directions.—Vlieland Lights or Lighthouses, in line 141°, or the rear light open westward of the front one, will keep a vessel westward of Noordwest and Wester Gronden and lead to the entrance to the Stortemelk.

It is not advisable to offer any further directions, as vessels should employ a pilot; but in cases of emergency vessels should steer between the red buoys on the starboard hand and the black buoys on the port hand into Boomkens Deep, and thence into Vlie Stroom, where there is perfect shelter, near the light vessel, in about 5 fathoms.

Stortemelk Gat is the best channel and is lighted. To enter, steer in with the Stortemelk Range Lights bearing 131° until the Vlieland front light changes to red; or from the Terschelling Bank Light Vessel steer in with the Vlieland Lights in line or the rear light a little open westward of the front light until the Stortemelk Range Lights are in line, when a course should be steered for the gas buoy, red, on starboard hand; then for the inner gas buoy, red, on the starboard hand, having passed which, continue, keeping the western gas buoy open a little northward of the eastern, until the rear Vlieland and rear Stortemelk Lights are in line 250°, when steer up the Vlie Stroom for the light vessel. The turning point into the Vlie Stroom is indicated by a red conical buoy with two balls as topmark.

Pilots are always to be obtained in the offing. The vessels, which are yawl rigged and painted black, carry the name "Terschelling" and the number of the vessel on the mainsail, and also a blue flag and number; also from the light vessel inside in the Vlie Stroom.

Tidal currents.—The flood current for the first four hours runs somewhat across the entrance to Thomas Smit Gat and for only two hours through it, whereas in the Stortemelk Gat both currents set fairly through.

Navigable depths to Harlingen.—A vessel of about 14 feet draft can usually enter by Thomas Smit or Stortemelk Gats and proceed to Harlingen, in the Zuider Zee, at high water neaps and of 10 feet draft at low water springs, if in charge of a pilot. From Harlingen southward to other ports in the sea there is a channel with from 7 to 8 feet at low water. Northward of Harlingen, beyond a distance of 4 miles, it is all shallow water.

Harlingen, on the northeast side of the Zuider Zee, is about 20 miles from the sea by the gats just described. It is connected by rail and the Nieuwe Zijlen Canal with Leeuwarden, 16 miles distant. The canal continues through Dokkum to the Lauwer Zee. The town has regular steam communication with Amsterdam and carries on a trade with Great Britain, Norway, and the Baltic. There are facilities for docking small vessels, and coal is usually to be had, from 200 to 500 tons being kept in stock.

Harlingen—Docks.—(See Appendix.)

Ameland, the island next eastward of Terschelling, and separated from it by a distance of about 1½ miles, lies at an average distance of 5 miles from the main, the whole of which space is mostly dry at low water. The island is about 12 miles in length east and west, 2 miles in breadth at the west end, and has three villages on it, Hollum, Ballum, and Nes. Hollum Church, near the west end of the island, with several windmills and beacons, are the most prominent objects. The island is mostly flat and occasionally suffers from inundations. Its pastures feed cattle, which are reared for exportation, but the principal dependence of its population is upon fishing and seafaring.

A stone breakwater connects the south side of Ameland, about 1.3 miles eastward of Nes, with the mainland near Holwerd. It is nearly covered at high water and has two openings marked by beacons, as is the space between the openings.

Ameland Light is group flashing white, exhibited, at a height of 187 feet, from a brown circular tower with white bands, on the northwest sand hill of Ameland; the light is visible 20 miles.

Nes Light is fixed white, exhibited, at a height of 16 feet, on the south shore of Ameland.

Holwerd Lights.—There are two fixed white lights at Holwerd, shown at heights of 25 and 10 feet, on the mainland.

These last two lights are only lighted when required for the ferry service between Ameland and the mainland.

Beacons.—Hollum Beacon, black, on the western point of Ameland, is 49 feet high and has a square screen topmark facing northwest. Ballum Beacon, situated on the north side of the island, about 2 miles eastward of the lighthouse, is black, 28 feet high, and has a topmark, consisting of a double square screen, facing north and west.

Signal and life-saving stations.—There are telegraph signal and storm signal stations at Ameland Lighthouse, a telegraph and lifeboat station at Hollum, and the same at Nes, on the inner side of the island, where also there is a day storm signal station.

Ameland Gat—Depths.—Ameland Gat, the channel between Ameland and Terschelling, is about ½ mile wide and is deep, but the approach is obstructed by shallow sand banks, named the Bornrif and Strandruggen, extending nearly 5 miles northwestward from Hollum and 3 miles seaward from the Bosch, on Terschelling Island.

Akkepolle and West Gats.—Through these banks are two gats or channels, known as the Akkepolle and West gats. The former, however, is at present closed, the West Gat alone being buoyed. In 1911 the least depth in the West Gat was 17 feet at low water. Along the shore of Ameland is the Strand Gat, which is sometimes closed. Ameland Flat, with depths of about 9 fathoms, extends some miles beyond the shallow banks mentioned.

Wrecks.—A wreck lies about 5 miles west of the West Gat, and the wreck of a steamer with two masts above water lies sunk on Bornrif. Several wrecks lie from 10 to 14 miles north-northeastward of Ameland Lighthouse.

Buoys—Direction.—A red and white checkered conical buoy, with triangle, and marked "Bornrif," is moored in about 10 fathoms at about ½ mile off the north extremity of the shallow banks fronting the Ameland Gat. A red conical buoy, with white band, marked "Westgat," with ball, in 6 fathoms, marks the approach to West Gat. A red buoy with ball, in about 7 fathoms, is moored about 3½ miles east of the checkered buoy.

West Gat is buoyed on the uniform system. Ameland Light bearing 140° leads to the red and white distinguishing buoy off the entrance. As all these gats are constantly liable to change and only fit for small craft with local knowledge, a further description would be more likely to mislead than otherwise.

Pinke Gat is a shallow and intricate passage over Wierummer Ground, between the east end of Ameland Flats and Englishmans Flat. It is marked by a few buoys for the guidance of the fishermen and is only available for small craft.

Englishmans Flat, between Ameland and Schiermonnikoog, is marked by two beacons and does not entirely cover at high water springs.

Schiermonnikoog, the easternmost of the islands off the coast of Friesland and lying 5 miles outside the mouth of Lauwer Zee, is nearly 7 miles in length by 1½ miles in breadth. The eastern portion of the island is a bare sand hill, but the other parts afford some good pasturage. On the west end of the island is the little village named Oosterburen, with a church and mill; on the north dune is a large bathing establishment.

Schiermonnikoog Light.—The two lighthouses on the sand hills near the western end of Schiermonnikoog Island (the southern one now unused) are circular towers, each 115 feet in height; from the northern of these, painted dark red seaward and gray landward, is exhibited a group flashing white light. The light is 140 feet above high water and is visible 18 miles. From the same tower is exhibited a fixed light, with white and red sectors, elevated 78 feet and visible 14 miles. The southern light is discontinued and the lighthouse used as a daymark. The lighthouses are 1,102 yards 122° apart.

Signal and life-saving stations.—There is a telegraph signal and storm signal station 86 yards, 45° from the lighthouse; a lifeboat, a telegraph, and pilot station near the village of Oosterburen; telegraph and storm signal station at Ostmahorn on the mainland, and a lifeboat at Paesens in Friesche Gat.

Friesche Gat, the channel leading toward Lauwer Zee and Groningen is between the sands extending from Schiermonnikoog, and Englishman's Flat and adjoining sands to the eastward of Ameland. There are three passages over the banks which are always working eastward, the Northwest Gat becoming the North Gat, which in turn becomes the Northeast Gat, the old Northeast Gat disappearing on the Kuipersbult or against Schiermonnikoog. While these gats are working eastward a new Northwest or Plaat Gat is forming on the north side of Englishman's Flat, between it and the buoys on the west side of Northwest Gat.

From the constant changes occurring in these channels a stranger should not attempt them without a pilot. In 1909 only one gat, the Plaat Gat, was available, the others having silted up. In January of that year the least depth on the bar of Plaat Gat was 13 feet.

Buoys.—The fairway buoy of Plaat Gat is a can buoy, striped red and black vertically, model hourglass, with upright cross. It lies in 6 fathoms with the northwest lighthouse of Schiermonnikoog bearing 109°, distant 6½ miles.

The Plaat Gat is buoyed on the uniform system.

A conical buoy painted in black and white vertical stripes, marked "Rif," and surmounted by a ball, is moored in 7½ fathoms on the northern edge of the Riff Shoals with Schiermonnikoog (unused) Lighthouse distant 4.3 miles and in line with Oosterburen Church Tower bearing 158°.

The channel is buoyed to about 2 miles above Ostmahorn.

Wreck.—A wreck, with one mast above water, lies near the entrance to Friesche Gat.

Tides.—It is high water, full and change, at Ameland Zee Gat at 8 h. 30 m.; springs rise 7¼ feet, neaps 5¾ feet; and at Schiermonnikoog at 9 h. 40 m.; springs rise 5¾ feet.

The Lauwer Zee is about 4 miles square and nearly all dry sand at low water, with a narrow and shallow channel, marked by stakes, leading to Groninger Deep, at its head. Oostmahorn is situated on the west side of the Lauwer Zee about 7 miles within Schiermonnikoog. Another narrow channel on the west side leads to Dokkumer Siel, 3½ miles southward of Ostmahorn, the entrance to the Nieuwe Zijlen Canal.

Oostmahorn Light is fixed, with white, red, and green sectors, exhibited at a height of 34 feet, from a lamp-post on the dyke. (See Light List.)

Wreck.—A wreck lies in the approach to Lauwer Zee, northward of Hoek van den Band, and near can buoy No. 1; it is marked by a wreck-marking buoy.

Reit Deep.—The southeastern corner of the Lauwer Zee is inclosed by a dyke extending southwestward from Zoutkamp. In the dyke close to Zuotkamp there is a lock admitting vessels to the channel, named Reit Deep, leading to Groningen where a canal connects with the Zuider Zee and with Delfzyl. The lock, which is only suitable for small craft, has a length of 115 feet, is 26 feet wide, with a depth of 13 feet on the sill below canal gauge. The depth in the channel inside the lock is 8 feet below canal gauge, which is 2 feet below N. A. P. The width of the canal at this level is 65 feet. Tugs can be obtained.

Zoutkamp Light, fixed white, is shown from the west mole at Zoutkamp; and one at the north training wall; also a white light at the canal entrance.

Nieuwe Zijlen Canal.—This canal, which connects the Lauwer Zee with the Zuider Zee at Harlingen, passing through Dokkum, Leeuwarder, and Franeker, is 33½ nautical miles in length. Its least width at canal gauge is 49 feet and least depth below that gauge about 7 feet. The lock at each end of the canal is 112 feet long, 27 feet wide, with a depth on the sill of nearly 9 feet below canal gauge, which gauge is 2 feet below N. A. P. (Ordinary low water is reckoned as 3 feet below the mean water level at Amsterdam, that level being termed as N. A. P.

The Lauwers is the name of the channel between Simons Sand east of Schiermonnikoog and Bosch Flat westward of Rottum. It has depths of 5 to 10 fathoms and is approached from the westward through West Gat, in which the depths are 3¼ to 5 fathoms as charted, being separated from it by a shallow bar. Neither of the approaches has more than 10 feet over the shallows. They are only available for local craft.

Southward of Bosch Flat it divides into several shallow channels running into Groningen Wad, the name of the sand fronting the shore. The western channel is named the Spruit and the eastern the Southeast Lauwers; both the latter are buoyed and their inner parts marked by stakes.

The Lauwers Ground is the flat extending some 2 miles seaward of this entrance, forming the south side of Huibert Gat of the Western Ems.

The Schild is a channel running into the Uithuizer Wad from Huibert Gat. It passes west of the Schild Ground and Rottum Island, between the latter and Rottumer Flat. It has a bar with a depth of 1½ fathoms as charted, and southward of Rottum is marked by stakes.

Beacon.—On the Bosch Flat is a beacon, 46 feet high, consisting of a mast with two shapes, the upper a truncated cone, the lower two planes, perpendicular to each other, with their axes vertical.

Ems River Approach—Rottum—Beacons.—Rottum, a low sandy island, situated 8 miles east of Schiermonnikoog, is 2.8 miles in length east and west by 1.3 miles broad, and lies at the western entrance to Ems River. Its western end is said to be gradually wearing away.

On the north sand dune of Rottum Island there is an iron beacon, with a ssuare lattice topmark, and on the southeast dune is another iron beacon, with a square lattice topmark surmounted by a ball. They are 72 and 82 feet, respectively, above high water. The beacons are 777 yards apart and in line 129° lead to the entrance of the Western Ems.

Westerems S. Light Vessel.—A light vessel showing, 33 feet above the sea, an unwatched occulting white light is moored in the approach to the Ems River in (approximately) latitude 53° 38′ 00″ N., longitude 6° 17′ 45″ E.

The light vessel is unmanned, 77 feet long and 19 feet beam, painted red, with "Westerems S." on each side, and has a single-pole mast, from which the light is exhibited.

Fog signal.—An aerial bell and a submarine bell each sound automatically one stroke every 12 seconds.

Watch buoy.—A red watch buoy, marked "Feuerschiff Westerems," in white letters, is moored about 330 yards north-northwestward of the vessel.

Rottum Light, fixed, with white and red sectors, is exhibited, at a height of 39 feet, from a black hexagonal framework tower near the center of the Rottum Island. (See Light List.)

Frontier.—The frontier between the Netherlands and Germany traverses the Western Ems from the head of the Dollert. Borkum Island is in German waters, and Rottum in those of the Netherlands.

Borkum Island is between the two outlets of the River Ems, named the Western and Eastern Ems. The island is about 5.8 miles in length by 3½ miles in breadth, with sand hills at each end. The inhabitants reside in a village at the west end. Most of the men are seafaring and the remainder support themselves by husbandry and the rearing of cattle. Of late years the island has become much frequented as a bathing place. In summer there is a regular steamer service between the island, Emden, and Leer, while in winter communication is maintained by ferryboat and steamer to Emden. The landing place is at a mole in Fischer Balje, which is connected with the village by a steam tram. There is a pier on the northwest side of the island, where landing is difficult from small boats when the flood current is running. There is telegraphic and telephonic communication with the mainland and the East Frisian Islands.

Borkum Island is connected with an extensive series of sands and sand banks, having a general northwest and southeast direction; the sands extending about 7 miles southeastward are mostly dry at low water and are named the Randzel.

Borkum Reef extends nearly 7 miles northwest of the island, with Hohe Reef on its southern part, said to be extending. It forms the north side of the entrance to the Western Ems.

Borkum Lights.—Borkum Island Lighthouse, a brown circular tower 197 feet high, is at Westland, the west extremity of the island. The light is fixed and group flashing white; it is elevated 207 feet above high water, and the flash is visible 21 miles and the fixed light 14 miles. At 14 to 16 miles a faint continuous light is seen.

An auxiliary fixed light, with white and red sectors, is shown 56 feet below the above, visible 12 and 10 miles, respectively.

At about 1,200 yards south of the principal lighthouse is a tower 91 feet high, painted in red and white bands, with a green dome, from which is exhibited, at an elevation of 105 feet above high water, a fixed, group flashing, and flashing white light, visible 16 miles. This light is so arranged as to show fixed over the channels.

Beacons.—Near the church at the west end of Borkum is the old lighthouse tower, and nearly ½ mile northwestward are two brick beacons, which at a distance resemble Gothic arches; that named the Great, or East Ems, 75 feet high and 109 feet above high water, has a triangular head. The Riff Gat, or New Beacon, 39 feet high and 68 feet above high water, has a square head. There is also a brick beacon near Hohe Horn, at the east end of the island, 24 feet high or 51 feet above high water, and having a triangular top. The water tower, 670 yards eastward of the Great Beacon, is conspicuous.

Searchlights.—Practice with searchlights occasionally takes place on Borkum Island. Care should be exercised at such times when navigating in the vicinity.

Signal and life-saving stations.—The southern lighthouse is the signal and telegraph station. The storm-signal mast is a short distance southward of the lighthouse; a red light is shown as a night storm signal.

A little westward of the storm-signal station is a mast, from which the condition of the ice in the Ems will be indicated by means of balls.

One ball signifies that navigation is obstructed by drift ice.

Two balls denote that on account of ice, navigation above the Emden Channel is no longer possible. Vessels passing Borkum Lighthouses may obtain, by signal, the condition of the ice on the German North Sea coast and at the western entrance of the Kaiser Wilhelm Canal.

Lifeboats are stationed near the storm-signal mast and on the north side of the island.

Vessels can communicate with the telegraph station by the International Code. It is connected with the telegraph system of Germany, and the office is always open.

Radio.—The signal station near Borkum Lighthouse is fitted with a radio apparatus for communicating with passing vessels; call letters K B M. Weather reports may be obtained upon application.

Telegraph cable.—A submarine telegraph cable connects Borkum with Teneriffe and is laid on the northern side of the fairway of

Western Ems, the position being indicated by three green buoys, marked "Telegraph" in white letters.

Telegraph cables are laid seaward from the northwest side of Borkum Island; also from the north side across the Eastern Ems to Juist, marked by green buoys, and from the east side of the island to Greetsiel.

Anchoring in the vicinity of this cable is prohibited.

Greetsiel—Telegraph cable.—The position of the submarine cable connecting Borkum with Greetsiel is marked on the western side of the fairway in Ley Bucht by 10 beacons, marked "Telegraph."

Borkum Flat extends about 4½ miles northwestward of Borkum Island. The bottom is principally coarse white sand, with small yellow or red stones, sometimes with black or white gravel, and occasionally with red or white shells. The depths upon the flat vary from 11 fathoms at about 10 miles from the light to 16 to 19 fathoms toward its extremity; eastward of it the depths differ but little from it, but to the westward they are rather more marked, being about 2 fathoms greater in most places. It may afford some guide to the position of the vessel in thick weather; the light vessel also serves as an excellent guide. Wrecks are charted in the neighborhood of Borkum Flat.

Borkum Riff Light Vessel is moored in about 14 fathoms, with Borkum Lighthouse bearing 117°, distant 24 miles. On the vessel are exhibited three fixed lights on separate masts, viz, a red light on the mainmast and a white light on the fore and mizzen masts. The red light is at an elevation of 46 feet and the white lights at 36 feet above the sea (39 and 29 feet in rough weather), visible 8 miles. A riding light is carried on the forestay about 5 feet above the rail.

The vessel is painted red, with "Borkum Riff" on sides, has a black globe on the fore and mizzen masts and a pyramidal basket cage and radio fittings on the mainmast.

When a vessel is seen steering a dangerous course, two guns will to be fired in quick succession and the signal J D of the International Code hoisted, signifying "You are standing into danger."

When the vessel, which occasionally drifts, is not in station, no lights will be exhibited at night, and by day a black flag will be hoisted at the main. During heavy gales the vessel occasionally breaks adrift altogether and has to run into port, but is replaced as soon as possible. The vessel is liable to be withdrawn for repairs without a substitute.

Fog signal.—During thick or foggy weather a steam siren is sounded. A bell is rung if siren is not in working order.

Submarine fog bell.—A submarine fog bell is sounded from the Borkum Riff Light Vessel during thick or foggy weather.

If a passing vessel desires to take in the submarine bell signals of this light vessel for practice, she must signify her intention, during clear weather, by hoisting a special flag—a white flag with a large yellow bell. The light vessel will, after the submarine bell has been set at work and as long as it continues, show the special flag also.

Telegraph.—This light vessel is fitted with a radio installation for communicating with Borkum Lighthouse; also with vessels at sea in cases of emergency. Call letters, F B R. Messages are received at the light vessel from passing ships by International Code during daylight. These are transmitted to Borkum Lighthouse by radio, thence to place of destination.

Storm signals are made from Borkum Riff Light Vessel in the daytime.

Ice signals.—During the winter months the master of the Borkum Riff Light Vessel is kept informed by telegraph of the state of the ice on the German North Sea coast and rivers, and vessels, by making a request for this information through the International Code, will have it supplied them by means of the signals described below:

Signals conveying request (new system).	International Code (signification).
P C A	Is there much ice at or in?
A D Y B	Ems.
A D W K	Jade.
A D T O	Elbe.
A D U F	Kaiser Wilhelm Canal.
A D S Z	Eider.

Signals in reply.	
Black ball	No ice; navigation unimpeded.
Black ball above red pennant	Dense, strong ice masses, or pack ice.
Black ball above red flag	Difficult drift ice.
Black ball above red pennant with red flag below.	Navigation only possible with the aid of ice breakers.
Black ball above red flag with red pennant below.	Navigation closed.
Red pennant	Ice conditions unknown.
Red pennant above red flag	Thin ice.
Red pennant above black ball	Strong drift ice.
Red pennant above red flag with black ball below.	Difficult for sailing vessels.
Red pennant above black ball with red flag below.	Difficult; possible for sailing vessels with the aid of tugs.
Red flag	Drift ice.
Red flag above black ball	Strong ice.
Red flag above red pennant	Passage kept open by ice breaker.
Red flag above black ball with red pennant below.	Very difficult; closed for sailing vessels.
Red flag above red pennant with black ball below.	Only possible for strongly built steamers.

It will be seen from the above that a single signal, such as a black ball, red pennant, or red flag, indicates that navigation is unobstructed; a combination of any two of the foregoing, that navigation may be obstructed; and a combination of any three, that navigation is very difficult, if not closed.

Tidal currents at Borkum Riff Light Vessel.—The flood current, which has a general direction of 89°, runs from five and three quarters hours before till one quarter hour after high water at Dover; its greatest strength is at three hours before high water at Dover, at which time the mean strength at springs is 1¼ knots; the greatest strength ever observed at this time was 2 knots. From the light vessel a vessel would probably drift about 6 miles at springs during one flood tide. The ebb current, which has a general direction of 277°, runs from three-quarters hour after till six and one-quarter hours after high water at Dover; its greatest strength is at four hours after high water at Dover, at which time the mean strength at springs is 1¼ knots; the greatest strength ever observed at this time was 1¾ knots. From the light vessel a vessel would probably drift about 5 miles at springs during one ebb tide. The duration of slack water is about one-half hour. (H. O. Charts 5213 to 5224, inclusive, give information as to currents in this vicinity of the North Sea.)

Ems River—General remarks.—The Ems rises 28 miles southwest from Minden. It then flows through Westphalia, traverses the western section of the former Kingdom of Hanover to the wide expanse named the Dollert, near the town of Emden, 10 miles below which is the town of Delfzyl. About 30 miles below the Dollert it joins the sea by the Western and Eastern Ems. For the last 15 miles of its course the Ems has a wide estuary, which is principally occupied by Borkum Island and the sands connected with it.

Depths.—Entering by the Western Ems Channel the least depth at low water is 19 feet and at high water 26 feet between Ballon and Geldzak Flats. There is a depth of 4 fathoms in the Riff Gat. There is a depth of 21 feet at low water and 29 feet at high water on the bar at the south end of the Randzel Gat, about 15 miles farther on. The distance of Emden Harbor from the sea is 37 miles, and the depth is not less than that given above.

The Huibert Gat has a least depth of about 5 fathoms at low water springs, but is reported to be shoaling, with the bar of the Randzel Gat within, as just mentioned.

Entering by the Eastern Ems, the least depth of 8 feet at low water and 16 feet at high water is found on the bar extending between the Randzel and the Pilsumer Wad.

The least depth, if bound to Delfzyl, is 16 feet at low water and 24 feet at high water on the bar between Robben Flat and the Hund Sand.

Pilots.—The German pilots for the Ems cruise in schooners which carry the German national flag at the mainmast head above the pilot flag and have the name "Ems" on fore and main sails. Emden is the German pilot station.

Ice.—The frost seldom begins before the middle of December, and lasts till March. The time of closing and opening the navigation of the river depends upon the weather.

In 1888–89 navigation was interrupted by ice in mid-November. In the middle of February the ice was packed for the fourth time that winter. On March 5 there was still much ice in the river.

Observations extending over a period of eight years (1903–1911) show that during the winter months ice appeared on an average for 25 days at the mouth of the Ems, for 15 days at Norderney, and for 3 days at Borkum.

Banks in the river.—Borkum Island and Reef, together with the Randzel, described on page 158, separate the Western Ems from the Eastern.

In the mouth of the Western Ems are Geldzak Flat, with 1¾ fathoms least water lying between the Riff Gat and the Western Ems; the Ballon Flat, with from 2 to 3 fathoms, and the Rottumerbult, with 1½ fathoms least water, separating the Western Ems from the Huibert Gat; and southward of the latter are the Schild Ground and Lauwers Ground, fronting Rottum Island, before mentioned. The Ballon Flat is extending northward.

The inner banks on the Netherlands side of the river are:

The Huibert Flat dries in places and lies eastward of Rottum Island. The eastern entrance of Huibert Gat, reported to be shoaling, is between the northwest extension of this bank and the east end of Ballon Flat.

Horsborn Sand, part of which does not cover at high water, lies southward of Huibert Flat. Shallow channels leading into the Schild lie on the west and south sides of this sand, which is steep-to on the eastern side.

Uithuizer Wad, which dries at low water, fronts the Netherlands shore as far as the Robben Flat. At the east end, opposite the Ems Horn Bank, the edge is marked by stakes and three red buoys mark the edge of the western part. Robben Flat, the continuation of the Wad, lies eastward of Ost Polder and dries in places.

Middle Grounds.—Mowen Steert (Meeuwen Staart), lying in a northwest and southeast direction, is situated southeastward of Huibert Flat and Horsborn Sand, between them and the Randzel. Several parts dry at low water and the remainder is very shallow. This bank separates the Alte Ems from Randzel Gat. This bank is reported to be extending to the westward and northwestward.

Ems Horn, situated southward of the Randzel between the eastern or principal channel of the Ems and the Duke Gat, has a patch dry at low water on its northern part; the southern part has about 3 feet of water. The Ems Horn has extended to the northward.

Der Hund and Paap Sands lie southward of Robben Flat and northeastward of Delfzyl, between the channel leading to the latter place and the Ostfriesischen Gat; they form one large bank, a considerable part of which dries from 2 to 5 feet at low water. On its northern extension is a patch on its west side that dries; these sands are extending to the westward into the Watum Bucht.

The Eastern Ems discharges between Borkum Reef and Brauer Flats on the west and Juist Reef, Kachelot Flat, and Memmert Sands southward of Juist Island on the east.

Farther inward, on the southwest side of the Eastern Ems, the Lutje Horn, a low islet, lies 1.3 miles southeastward of Hohe Horn, the eastern extremity of Borkum Island, and 1 mile farther eastward the Konigs Flat extends north-northeastward into the channel from the Randzel. On the east side of the Eastern Ems are the Nordland, Koper, and Hamburger Sands, which extend from 9½ to 4½ miles from the mainland and dry at low water. The Schuiten Sand is a projection northwestward from the Pilsumer Wad, and dries in parts at low water. It lies between the Wester Balje which leads to the Western Ems, and the Ley leading to Norden. Southward of the Pilsumer Wad, the eastern shore as far as Knock Point is fronted by the Manslagter Nacken and Rysumer Nacken, parts of the continuous bank fronting the shore, which dries out 1½ miles in places.

Buoyage.—The banks in the approach to the Ems are marked on their seaward side, as well as the approach to the several gats, by distinguishing buoys, as follows. They are liable to break adrift:

Huibert Gat Buoy is moored in about 6 fathoms at about 1.8 miles 272° of the west extremity of Rottumerbult Sand, north side of entrance to Huibert Gat. It is a red and black vertically striped can buoy, surmounted by a conical framework, with a ball as topmark, and marked Huibert Gat in white letters. Close to it, to the southeast, lies a floating beacon painted in a similar manner, to mark the position in the event of the distinguishing buoy being dragged out of position by ice.

The Western Ems Buoy lies in 8 fathoms at 1¼ miles 286° from the west extremity of Geldzak Flat, north side of entrance to the gat. It is a black conical buoy with black conical iron frame surmounted by a mirror as topmark, and marked "Wester Ems" in white letters. A black floating beacon, also marked "Wester Ems," and with a cone-shaped topmark, lies near it to the northeastward, to mark the position as mentioned for the buoy off Huibert Gat.

Riff Gat Buoy lies in about 10 fathoms in the fairway of the approach to the gat at about 2.8 miles northwest of the outer buoys in the gat. It is a red and black vertically striped whistle buoy, marked "Riffgat" in white letters.

Eastern Ems Buoy lies in 9 fathoms in the fairway, about 2.7 miles 277° of the extremity of Juist Reef and 1 mile northward of the outer red buoy of the gat. It is a conical buoy with a high conical frame as superstructure, painted red and black in vertical stripes with an upright cross as topmark, and marked "Oster Ems" in white letters.

A conical buoy with a cross topmark, painted red and black in vertical stripes, marked "Möwen Steert N.", is moored off the northwestern end of Möwen Steert.

Caution.—The changes in the channels, sands, and buoyage in the river are so frequent that no stranger should attempt to enter without a pilot. The buoys are liable to be displaced or injured when there is ice in the river. The buoyage system in the river is that uniformly in use in German waters—viz, red spar buoys on the starboard hand and black conical buoys on the port hand entering.

When necessary on account of ice the summer buoyage within Borkum Island is replaced by winter buoyage. During some winters the summer buoyage, with the exception of the light buoys, is allowed to remain as far as Emden.

Lights.—The fixed and flashing lights are so arranged that a sector of fixed white light is shown through the fairway of the channels and flashing sectors on either side over the banks.

Single flashes, or groups consisting of an odd number of flashes, are shown over the banks on the starboard side of the channel entering, and groups of even numbers of flashes over the banks on the port side.

Entrances—Huibert Gat.—Huibert Gat has a least depth of about 5¼ fathoms abreast the outer buoys. The depths in the gat between Ballon Flat and Huibert Flat are subject to sudden change. The channel between these flats is shoaling, and the Huibert Flat is extending to the northwestward. The depth in mid-channel is 5¼ fathoms, but is reported to be shoaling, with deeper water on the gas buoy side. Great caution is necessary when navigating this channel, as the flood tide sets strongly toward Huibert Flat.

A distinguishing buoy, before referred to, lies near the fairway off the western entrance. The red or starboard hand buoys of the Huibert Gat are marked with white letters, thus, H A, H B, etc., and the black or port hand buoys with a letter and a number H 1, H 2, etc., commencing from seaward. All the buoys except light buoys carry the letter H as topmark.

H 5 is a black light buoy, marked "Huibertgat," in 5½ fathoms, showing two red flashes every 8½ seconds. The north end of the Huibert Flat is marked by a red and black vertically striped light buoy with "Westerems" on it, which shows an occulting white light every 8 seconds, thus, light 4 seconds, eclipse 4 seconds. This buoy is common to Huibert Gat and Western Ems. The fairway is also marked at night by sectors of fixed white light shown from Borkum Lighthouses.

The Western Ems has some patches of about 19 feet on its bar at low water about 6 miles from Borkum Light and abreast W C red buoy and W 4 black buoy. It joins Huibert Gat within. Thence the buoyed channel is through the Randzel Gat. Alte Ems, the southern channel, is not so well buoyed and is not so direct.

A distinguishing buoy with a triple reflector and a fixed white sector of light from Borkum Light mark the fairway of the entrance to the Western Ems.

The buoys are marked "W A," "W B," etc., on the starboard hand entering, and "W 1," "W 2," etc., on the port hand. All have a W as topmark. W B and W D have a ball in addition. These topmarks are discontinued after W D and W 5 buoys. The tidal currents run fairly in the direction of the channel.

Riff Gat is more subject to change than those mentioned. Vessels of about 13 feet draft can usually take it. Its bar, with 4 fathoms at low water, is between Geldzak Flat and Borkum Reef; thence it joins Huibert Gat. A whistle buoy lies in the fairway of the approach to it.

The channel buoys are marked "R A," "R B," etc., on the starboard hand entering and "R 1," "R 2," etc., on the port hand. The channel is not lighted.

Eastern Ems, which leads northward of Borkum Island and Reef, has 16 feet on its bar at low water, which extends from the spit at the northeastern end of Brauer Flats in a northerly direction to Juist Reef, southeastward of O E Buoy, and is much deeper within; but to reach the Ems the flat connecting the Randzel Sands with the sands from the mainland has to be crossed, where there is only about 8 feet at low water.

The channel buoys are marked "O A," "O B," etc., on the starboard hand entering and "O 1," "O 2," etc., on the port hand. The first five buoys on each side of the channel, counting from seaward, have an O as topmark.

Several channels, the inner parts of which dry at low water, extend eastward from the Eastern Ems through the extensive sands which front this part of the coast and which extend from 9½ to 4½ miles from the shore. The outer parts of these channels are buoyed and the inner parts marked by stakes. Of these, Memmert Balje, south of Memmert Sand, leads toward Norderney; Bants Balje leads toward Norderney and Norddeich; the Ley, with its continuation, Ley Bucht, branches off into three channels leading to Norddeich, Norden, and Greetsiel, respectively.

On the eastern or German side of the river the following lights are exhibited:

Randzel Light, group occulting, with white and green sectors, is exhibited, 46 feet above high water, from a beacon 47 feet in height, situated on the northwest point of the Randzel Bank southward of the entrance to Fischer Balje.

Binnen Randzel Light, fixed, with white and red sectors, is exhibited, at a height of 46 feet, from a beacon on the south point of the Randzel Bank.

Pilsum Light, fixed, occulting, and group flashing white, is exhibited, at a height of 49 feet, from a red circular iron tower situated on the shore at Pilsum, about 8 miles, 92°, from the Binnen Randzel. (See Light List.)

Kampen Light, fixed, occulting, and group flashing white, is exhibited, at a height of 203 feet, from a red iron tripod, surmounted by a white cylinder and dark-brown lantern, about 4 miles northward of Knock Point; it is visible 20 miles.

Knock Light, fixed, with white and red sectors, is exhibited, at a height of 29 feet, from a gray iron tower on the dyke at Knock Point.

Emden Range Lights.—The front light is occulting, white, exhibited, at a height of 46 feet, from a latticework mast on the new east pier.

The rear light is occulting, white, exhibited, at a height of 90 feet, from a latticework mast surmounted by a triangle, 700 yards, 82°, from front light.

A fixed red light is exhibited, at a height of 33 feet, from a gray iron tower on the end of the west pier.

A fixed green light is exhibited, at a height of 33 feet, from a red iron framework at the head of the new east pier.

Range lights are shown at the entrance to the canal; the front light is occulting, white, exhibited, at a height of 20 feet, from a gray post.

The rear light is fixed, white, exhibited, at a height of 44 feet, from a gray iron mast situated 33°, 164 yards from the front light, There is a fog bell.

On the western or Netherlands side of the river the lights are as follows:

Watum Light, fixed, occulting, and group flashing, with white and red sectors, is exhibited, at a height of 39 feet, from a stone dwelling at Watum, nearly abreast Kampen and about 3 miles north of Delfzyl.

Delfzyl Light, fixed, occulting, and group flashing, with white and red sectors, is exhibited, at a height of 52 feet, from a stone dwelling situated on the dyke north of the harbor.

A fixed green light is exhibited from the west mole and a fixed red light from the east mole; each light is visible 1 mile, and is exhibited, at a height of 21 feet, from a yellow square iron frame.

A white light is shown from each sluice; three red lights, triangular, indicate that the sluices are not to be approached.

Termunterzyl Light.—A fixed white light, 30 feet above high water and visible 2 miles, is shown from an iron post on the west mole of Termunterzyl, about 4 miles southeast from Delfzyl. (See Light List.)

Borkum to Delfzyl and Emden—Channels—Depths.—Randzel Gat is the buoyed and direct channel southward of Borkum, between the Randzel and Mowen Steert Banks, both of which are steep-to. It is deep and straight but is barred at its south end, where there is a depth of 21 feet at low water; the buoyage is marked in continuation of that of the Western Ems entrance channel. A sector of fixed white light from Kampen Lighthouse marks the fairway at night.

Fischer Balje, on the north side of Randzel Gat, is an inlet leading to a mole at the southeast extremity of Borkum Island, affording good anchorage for small vessels. Off its entrance is moored a black light buoy marked "Fischer Balje," which shows an occulting red light every 8 seconds, thus: light 4 seconds, eclipse 4 seconds. This light buoy is replaced in winter by a floating beacon painted in the same manner as the buoy. A gray mooring buoy for torpedo boats lies northward of the light buoy. There is a depth of 9½ feet at low water springs on the bar of Fischer Balje with deeper water within.

Off the south end of the Mowen Steert Bank lies a red and black vertically striped beacon buoy, surmounted by a staff and flag, and marked "Mowen Steert S."

The channel on the southwest side of the Mowen Steert, named the Alte Ems, has depths of 7 to 14 fathoms, but is buoyed only on its southern side. This channel should be navigated with caution, owing to the reported extension of Mowen Steert.

Anchorage.—There is secure anchorage in Randzel Gat in about 7 fathoms, particularly during northerly winds; and also southward of Randzel Gat and Mowen Steert Bank, off Uithuizer Wad (sands) in 8 to 11 fathoms, good holding ground; also in 5 to 6 fathoms on the north side of the channel between the Randzel and Ems Horn, northward of the sector of fixed light from Pilsum, and in the three flash sector from Kampen Lighthouse.

Ems Horn.—This bank is reported to be extending to the northward.

Main channel.—At the south end of the Randzel Gat the channel bifurcates, the main fairway passing northward and eastward of the Ems Horn and the Duke Gat passing westward of that sand. The west and south extremities of the Ems Horn Sand are marked by red and black vertically striped beacon buoys with cross as topmark and Marked "Emshorn N" and "Emshorn S," respectively.

The main channel has a least depth of 24 feet at low water.

The buoyage on the north side of the Ems Horn Sand is marked in continuation of that of the Randzel Gat. On the east side of the sand, after the junction with the channel from the Eastern Ems, the buoyage is marked "E A," "E B," etc., on the starboard hand entering, and "E 1," "E 2," etc., on the port hand. Buoy E C, red and black vertically striped, exhibits an occulting white light. Sectors of fixed white light from Pilsum, Kampen, and Delfzyl lighthouses mark the fairway at night.

Robben Flat.—A channel with a depth of 16 feet at low water springs is situated westward of Robben Flat.

The Duke Gat lies between the Ems Horn Sand and the steep edge of the Uithuizer Wad and Robben Flat. The buoyage is marked "D A," etc., on the starboard hand entering and "D 1," etc., on the port hand. It has a least depth of 24 feet at low water at the south end near the south Ems Horn Buoy. The edge of the Wad opposite the south part of the Ems Horn is marked by stakes.

The channel has been reported to be shoaling.

The channel to Delfzyl lies across the bank between the Robben Flat and the Hund Sand, passing close to a red and black vertically striped light buoy, exhibiting a fixed green light, marked "Hund N," moored in 5 fathoms. The buoyage of the channel through Watum Bucht is marked in continuation of that eastward of Ems Horn Sand. (See above.)

The fairway is marked at night by sectors of fixed white light from Watum and Delfzyl lighthouses.

In the channel from Delfzyl to Emden, passing close to a red and black vertically striped beacon buoy, marked "Paapsand S," moored in 4¼ fathoms, and surmounted by an upright cross, the depth is 15 feet at low water, with the Emden Range Lights in line, but it is very changeable here.

Paap Sand.—This bank is reported to be extending to the westward, and the depth in Watum Bucht between buoys E 8 and E 9 is 2½ fathoms.

The channel to Emden.—**Ostfriesischen Gat**, along the east side of the Hund and Paap Sands, is the direct channel to Emden from abreast the Robben Flat, and extends as far as Knock Point. It has a depth of 22 feet least water, which is maintained by dredging.

The channel is buoyed, the system of marking the buoys being the same as already mentioned for the various gats, the initial letter being G. Five black light buoys mark the east side of the channel. G 1, G 3, and G 5 each exhibit a group occulting white light, showing a group of two eclipses every 8½ seconds; G 2 and G 4 each exhibit a group occulting red light, showing a group of two eclipses every 8½ seconds. Toward the south end of the gat, on the edge of the Paap Sand, is a red light buoy marked "G E," which shows an occulting green light every 8 seconds. When drift ice is expected these light buoys are removed and replaced by buoys or floating beacons painted in a similar manner; those on the port hand entering by tall buoys with long, conical-shaped top and on the starboard hand by floating beacons.

From off Knock Point the dredged and buoyed channel to Emden about 5 miles in length and 220 yards in width, has a low water depth of 22 feet, which depth it is intended to increase. The depth in the channel has to be maintained by dredging.

The buoyage on the starboard hand entering is marked "E a," "E b," etc., and on the port hand the marking is a continuation of that of the Delfzyl Channel, commencing with E 8. Off the harbor mouth at Emden is a red light buoy marked "E g. Emden," which shows an occulting white light every 8 seconds, thus: light 4 seconds eclipse 4 seconds. This light buoy is replaced, when drift ice is expected, by a floating beacon painted in the same manner as the buoy. The fairway of the channel is indicated at night by range lights, which lead to the mouth of Emden Harbor.

Tides.—The high water interval at Borkum is 10 h. 45 m.; spring range 9½ feet, mean range 8 feet; at Delfzyl 11 h. 19 m.; spring range 10¾ feet, mean range 9½ feet; and at Emden 0 h. 00 m.; spring range 12 feet, mean range 10 feet. (See General Tide Tables.)

TIDAL CURRENTS.

Off the mouth (lat. 53° 49′ N., long. 6° 28′ E.) the flood current, which has a general direction of 87°, runs from five and one-half hours before till one-half hour after high water at Dover; its greatest velocity is at three hours before high water at Dover, at which time the mean velocity is 1¼ knots; the greatest velocity ever observed at this time was nearly 2 knots. The ebb current, general direction 279°, runs from one hour after till six hours before high water at Dover; its greatest velocity is at four hours after high water at Dover, at which time the mean velocity is 1 knot; the greatest velocity ever observed at this time was 1¾ knots. The duration of slack water is about half an hour.

No detailed tidal current observations for the bars and channels of the Ems are available. Owing to the river being greatly obstructed by banks the tidal currents vary greatly, both in direction and force, at different positions, and no reliance can be placed on any estimate of drift on either side.

In the entrance channels, the velocity of the current is about 2¾ knots, and the flood current runs from five and three-quarter hours till high water at Dover.

Off Borkum, the flood current runs for about five and one-half hours, or from about five hours before till about half an hour after high water at Dover.

Off Emden the current turns about one and one-half hours later than off Borkum.

In the Western Ems.—From the junction of the three entrances to the Western Ems the flood current sets to the southeastward through Randzel Gat and Alte Ems. At the south end of the former the current divides, one part flowing round the north and east sides of Ems Horn Bank, where it meets the flood from the Eastern Ems and the other flowing through the Duke Gat. Off the south end of Ems Horn the main current sets through Watum Bucht, another part flowing through Ostfriesischen Gat, and both reuniting off the Knock. Between Borkum and the Knock the water rises for six hours and falls for six and one-half hours.

At Delfzyl, two-thirds of the total rise takes place in the first half of the flood and the same proportion of the fall in the last half of the ebb. The tidal currents run at a velocity of about 3 knots off Delfzyl.

Eastern Ems.—At the mouth of the Eastern Ems the flood sets in a southeasterly direction; south of the Memmert Sand a branch flows up the Memmert Balje, and eastward of the Konigs Flat the current sets through the various channels, Bants Balje, Ley, and Wester Balje, the branch flowing through the latter meeting the tide from the Randzel Gat northeastward of Ems Horn. The flood sets strongly over the Juist Reef and toward the Koper Sand abreast of the Konigs Flat.

The tides are much influenced by the winds. West and northwest winds tend to raise the level of the water, while those from south and east have a contrary effect.

Delfzyl, or Delfzijl, is a Netherlands port of some importance, situated on the western shore of Ems River about 9 miles below the entrance of Emden Harbor and about 27 miles from the sea.

There is a depth of from 27¾ to 29½ feet in the outer harbor, and a wharf 752 feet long with a depth alongside of 27¾ feet, and equipped with three 5-ton cranes.

Docks.—(See Appendix.)

Basins.—The outer basin, 2,600 feet in length by 500 feet in width, is tidal, but is connected with an inner harbor by a lock 196 feet by 34 feet, with a depth of 15¾ feet of water on the sill at high water springs. The inner basin is 1,200 feet by 270 feet, has a depth of 14¼ feet, and 15 feet on the sill at high water springs.

There are slips for hauling up small craft, and the two pontoons take vessels of 700 and 800 tons, respectively.

A new quay has been built and the depth in the harbor increased by dredging.

Navigable depths.—The depth in the outer harbor and the fairway to it is about 22 feet at low water, which depth it is necessary to maintain by dredging; in the inner part of the approach to the Ems Canal the depth is 15¾ feet; springs rise 9 feet.

Anchorage.—There is anchorage in Delfzyl Road in from 4 to 5 fathoms.

There is a storm-signal station at Delfzyl, also a pilot station.

Supplies.—Provisions, water, coal, and other requirements of vessels can be obtained and small repairs can be executed.

The Ems Canal, from Delfzyl to Groningen, is about 16½ miles in length, from 92 to 105 feet in width at the water level, and admits vessels up to 13¾ feet draft. The depth in this canal is 14¾ feet.

The lock at Delfzyl is 196 feet in length by 34 feet in breadth.

Emden, situated about 35 miles from the sea, has, with the opening of the Dortmund-Ems Canal, become a depot and an important outlet by the sea for the industrial products of the Province of Westphalia. The harbors have been improved and deepened, and works are still in progress, and the trade has consequently largely increased.

The United States is represented by a consular agent.

Depths.—The least depth between Emden and the sea, passing by Huibert Gat, is at the east end of the gat, 21 feet at low water springs. The channel from the Ems to Emden is dredged to 22 feet.

Emden Harbor is divided into three parts—the outer haven, the new inner haven, and the old inner haven.

The outer haven below the locks is a large tidal basin about 1,650 yards long and 150 yards broad, with a depth of 32 feet at high water springs and at low water of not less than 23 feet. Suction dredgers are constantly employed in maintaining the above depths.

On the western side of the outer haven is a quay 1,226 yards long; seven or eight steamers can lie alongside. On this quay are several sheds with railway communication. Northward of these sheds is a large coal tip which will unload twelve railroad cars per hour and discharge their contents into vessels lying alongside. There are also ten electric traveling cranes and one large crane with a lifting power of 40 tons. On the eastern side of the outer haven are dolphins where six vessels can moor.

The new inner haven is separated from the outer by two locks, the western one of which is no longer used. The eastern lock is 377 feet in length, 49 feet in breadth, and has a depth on the sill of 21½ feet at high water.

The new inner haven extends from the locks at the northern end of the outer haven to the railroad bridge and has a depth of from 18 to 23 feet. On the western side are three basins each about 1,100 feet long, 200 feet broad, and 20 feet deep. These basins are chiefly used by private firms. On the eastern side of this haven, at the northern end, is the Government yard for the repair of dredgers, buoys, etc., which possesses a 25-ton crane. Further southward on this side is a large goods shed with railroad communication and ten cranes. Below this is the entrance to the Ems-Dortmund Canal.

The old inner haven consists of several basins in the town above the swinging railroad bridge. The Ems-Jade Canal joins it by means of a lock at its east end. This harbor can only be used by comparatively small craft.

A dock is connected with the new inner haven, and also with the river by means of a lock 820 feet long by 312 feet wide, with a depth of 34½ feet at low water; the above is furnished with quays, sheds, etc. Range lights near the lock lead to the entrance.

Floating dock—Slips.—There is a floating dock, 314 feet long, 59 feet wide at entrance, and with 2,800 tons lifting power.

There are six slipways, the cradles of which are from 80 to 150 feet in length. The greatest draft over the cradle blocks is 15 feet. (See Appendix.)

The Ems-Dortmund Canal is about 167 miles in length, and with its continuations is stated to be 500 miles in length, 100 feet wide at the water level, with a depth of 8½ feet. The canal, after partially following the course of the Ems, passes through Munster, the capital of Westphalia, and on to Herne, etc. Between Munster and Herne is the branch to Dortmund. Craft are raised in an elevator to this branch, which is stated to be 51 feet above the main canal.

The Ems-Dortmund Canal has developed a large amount of trade, as above stated. Its southern entrance is in Emden Harbor, its lower section being a branch canal from Oldersum, about 5 miles to the southeastward. The traffic is liable to be interrupted in winter by ice.

The Rhine-Herne, a new canal (proposed), is to connect Herne with the Rhine River, via Oberhausen to Laar. It will be about 21 miles in length; width at bottom, 49 feet; width at water level, 113 feet; depth of water, 11 feet 5 inches. Two locks will connect it with the Rhine at Ruhrort, and the other end will connect with the Dortmund-Ems Canal close to Herne. An alimentary canal will connect with Datteln and Hamm. The locks will have a length of 203 feet and a clear width of 33 feet. The clear height under the bridges will be 16 feet 5 inches.

Another section (proposed) of the German Midland is to connect the Elbe with the Rhine.

NOTE.—Owing to the present war no notice has been received as to the completion of these proposed canals.

The Ems-Jade Canal is 39 miles in length, 59 feet wide at the top, and 28 feet at the bottom, with a depth of 6 feet 10 inches on an average, but usually less in summer, and is intended for both military and commercial purposes. It connects Emden Harbor with Wilhelmshaven. The locks are 108¼ feet in length, 21¼ feet in breadth, and 6 feet 10 inches deep.

The canal can be used by vessels not exceeding 108 feet in length, 20 feet in breadth, and 6 feet in draft.

Mooring berths and turning places as well as canal harbors have been constructed in both canals at suitable places.

Repairs.—Tugs, lighters, and other small craft are built at Emden. The Nordsee-werke shipbuilding yard can turn out larger vessels and is fitted with modern appliances. It possesses a floating dock and undertakes repairs to vessels; minor repairs to machinery can be effected. There is a building yard, with workshops, belonging to the Imperial Harbor Works authority.

There are ten steam cranes at Emden.

Coal.—About 12,000 tons of coal are kept in stock for supplying shipping. The coal wharf is 250 feet long with a depth of 22 feet at low water.

Tugs are stationed at Emden.

Trade.—The principal imports are grain, iron ore, timber, piece goods, coal, sugar, bacon, etc., and the exports iron and steel manufactures, coal, bog ore, etc.

The trade of the port is mainly transshipment. The most notable industry of the town of Emden is its herring fishery.

The town is connected by rail and telegraph with the system of Germany. The telegraph office is always open.

Time signal.—A ball is dropped and a light extinguished at the time-ball tower at noon, 1 h., and midnight, of the standard time of the fifteenth meridian, corresponding to 23 h., noon, and 11 h., Greenwich mean time, respectively. The ball is hoisted at half-mast 10 minutes and close up 5 minutes before being dropped. The light is exhibited at the same time that the ball is hoisted close up.

In the event of the time ball not being dropped at the correct time a small red ball will be hoisted.

Signal and life-saving stations.—There is a storm-signal station at Emden and also a lifeboat. A storm-signal station is at Oldersum, at which a red lantern light will be exhibited if an atmospheric disturbance is reported.

Radio.—There is a radio station at Kampen, some 11 miles down the river.

Port regulations.—Steamers are required to reduce speed when passing small or deeply laden vessels with low freeboard, dredgers, etc., so that no danger can arise from the swell caused by them. If necessary, the vessel's way must be stopped entirely until the danger is past.

Vessels laden with powder or explosives must fly a black flag and are prohibited from navigating at night.

Vessels must carefully avoid causing any injury to the bank, shore establishments, works, and piers.

Steamers must keep as far as possible from the banks and from the river structures and dredgers. In sharp bends of the fairway steam vessels must proceed at a moderate speed; also when near places marked as dangerous or under construction, as well as when near such places where raising operations, diving, or blasting is taking place. By day all these places are marked by a white flag and at night by three lights placed vertically, the upper and lower ones being white and the middle one red.

Between the South Emshorn and Papenburg, as well as from Leerort to Leer, seagoing vessels which owing to their draft or length are obliged to keep in the deepest fairway must, provided they are in charge of an official pilot, hoist the following signal:

(*a*) By day a red flag at the foremost head.

(*b*) By night a red lantern above a white top light before the foremast.

When being towed, only the vessel towed is to show these signals. Vessels which are not in charge of an official pilot must not exhibit these signals.

Ballast, ashes, etc., must only be thrown overboard where permitted by the proper authority.

Anchorage is prohibited on the lines of range lights and in the vicinity of telegraph or other cables the position of which is indicated by notice boards.

Directions for entering Ems River.—Vessels bound to the Ems from the northwestward should make Borkum Riff Light Vessel, whence a course may be shaped for the distinguishing buoy of the gat it is proposed to enter. Vessels from the westward may check their position by bearings of Schiermonnikoog and Borkum lighthouses and by the depth of water, which shoals gradually toward the entrances of Huibert Gat and Western Ems, but much less so farther eastward.

At night the line of obscuration of the Schiermonnikoog Light leads close to and over the outer ends of the Ballon and Geldzak Flats.

A pilot should be taken on board before attempting to enter the river.

These directions are given for cases of emergency.

Huibert Gat.—Pass a good ½ mile southward of the distinguishing buoy and steer about 92° for Borkum South Lighthouse, leaving red buoys to starboard and black buoys to port, until midway between H C and H D buoys, when the course should be altered to pass ½ mile northward of Huibert Gat Light Buoy and ¼ mile northward of Westerems Light Buoy.

Great caution is required here, as the flood tide sets strongly toward the Huibert Flat, which is extending to the northwestward, thus contracting the navigable width of the channel considerably.

The red beacon buoy W D, with W as topmark, marks the north side of the eastern entrance to the gat. Having passed the eastern light buoy, continue until Borkum South Lighthouse bears 107°. The least depth in the gat, 5¼ fathoms, but reported to be shoaling, is found at the east end.

Sailing vessels should only use this gat with southerly winds, on account of the dangerous shoals to the southward, toward which the flood tide sets.

By night.—Before losing sight of Schiermonnikoog Light get into the sector of fixed white light from Borkum South Lighthouse bearing 92°. Groups of five flashes from the same light indicate that the vessel is southward of the line of fairway and groups of two flashes that the vessel is to the northward. Steer for Borkum Light on the above bearing, within the fixed sector, and when within 2 miles of Huibert Gat Light Buoy steer more to the northward, passing ¼ mile northward of Westerems Light Buoy, and the course continued until within the northern sector of fixed white light from Borkum South Lighthouse, bearing 107°, and follow the directions given below for Western Ems and Randzel Gat.

Western Ems.—The beacons on Rottum Island in line 129° lead toward the entrance; pass southward of the distinguishing buoy and steer toward Borkum South Lighthouse about 108°, leaving red buoys to starboard and black to port. The Ballon Flat has recently extended to the northward. The least depth in the channel is 19 feet at low water toward the east end.

By night.—Having entered the northern sector of fixed white light shown from Borkum South Lighthouse, before losing sight of the light of Schiermonnikoog steer toward the former 108°. Groups of four flashes from the same lighthouse indicate that a vessel is northward of the fairway and single flashes that she is to the southward. Continue within the fixed sector until the light from Borkum North Lighthouse is sighted bearing 90° 30′. Kampen white light, which has hitherto been showing single flashes, will now show fixed, and Rottum Island Light will have changed from fixed red to white. (For further directions see below.)

Riff Gat, the old lighthouse tower, and the new beacon on Borkum Island in line 121°, lead toward the gat, northward of the whistle buoy. Close that buoy and steer 122° 30′ for the entrance, when the course must be directed by the buoys. The least depth is about 19 feet. In heavy weather the sea is stated to break across the channel. The Riff Gat is not lighted.

From Borkum to Emden.—From the junction of the above-mentioned gats the course by day is through the center of the buoyed Randzel Gat on an 83° course, across the 21-foot bar at the south end, and when Pilsum Lighthouse bears 87° steer toward it, leaving the Ems Horn N. buoy on the starboard hand, and follow the channel, which curves round the Ems Horn Bank, leaving the red buoys to starboard and the black to port. When passing northward of the Ems Horn Bank keep well in the middle of the fairway, as that bank has extended northward.

From abreast the Ems Horn S. buoy a 182° course leads to the entrance of the Ostfriesischen Gat, through which a 151° course leads between the red buoys and light buoys on the starboard hand and the black buoys and light buoys on the port, to abreast the Knock, whence the dredged channel leads toward Emden and is well buoyed. The breadth of the Ostfriesischen Gat Channel is in places only 330 yards, and that of the channel to Emden only 220 yards; both have depths of 22 feet at low water. In the latter channel light-draft vessels must give way to those of heavy draft.

From the south end of Randzel Gat vessels may take the shorter passage through Duke Gat, westward of the Ems Horn Bank, passing between the red and black vertically striped buoy with flag off the southeast end of Mowen Steert and the Ems Horn N. buoy, and then steering 134° between the buoys on either side. The bar at the southeast end of the gat is narrow, with 4 fathoms of water. This channel is reported to be shoaling.

By night.—From the position off the west end of Borkum Island mentioned at the end of the directions for the Western Ems steer 128° toward Kampen, keeping in the sector of fixed white light shown from that lighthouse. The light will show single flashes if westward of the fairway and double flashes if to the eastward. The light buoy off Fischer Balje showing an occulting red light and the Randzel occulting white light are left to port. The above course is continued until the Binnen Randzel fixed light changes from red to white, and the white light of Pilsum, which has hitherto shown double flashes, changes to fixed. The course is then altered to 88° for Pilsum Light, keeping in the fixed sector. The southern limit of this sector should not be closely approached, as the Ems Horn

Bank has extended across it slightly. Pilsum Light shows single flashes on the south side of the fixed sector and double flashes on the north.

Steer toward Pilsum Light until Kampen white light again shows fixed, when alter course for it about 142°. This light shows a triple flash if westward of the fixed sector and a quadruple flash if eastward. Continue toward Kampen until within a sector of fixed white light shown from Delfzyl, when steer toward it about 183°. This light shows single flashes if westward of the fixed sector and double flashes if eastward. Keep on the above course for about 3¼ miles until Watum Light is obscured, then steer for G 1 light buoy of the Ostfriesischen Gat, when a 151° course may be steered through the gat, leaving all light buoys to port except buoy G D, with occulting green light to starboard.

When Knock fixed light changes from white to red the vessel is nearly abreast of G 4 light buoy with occulting white light, and the course must be altered to 111°, steering to pass close to G 5 light buoy with occulting red light. Having passed the latter buoy continue the course with the last two light buoys in line astern until the Emden white range lights are in line—the front light occulting, the rear light fixed—when steer for them until up to the light buoy with occulting white light moored off the harbor. Two range lights similar to the above lead up Emden Harbor between the piers.

When off the west end of Borkum, should Kampen Light not be visible, the Randzel Light will enable a course to be shaped into Randzel Gat. This light shows green over the west ends of Borkum Island and Hohe Reef, when bearing southward of 123°. When past the Randzel Light and abreast W 8 buoy, bring the light in one with Borkum Light; these in line astern 317° lead eastward of the south end of the Mowen Steert and up to the beacon buoy moored off it.

To Delfzyl.—If bound to Delfzyl from sea, leave the main channel when nearly abreast Hund N. buoy and bring the group flashing red lights on buoys D 4 and D 6 in line, passing close westward of buoy D 5. When buoy D 4 is passed bring Delfzyl Light just eastward of buoy D 6 until Watum fixed light becomes visible, when steer for it until Delfzyl Light changes to a fixed light.

Proceeding from Delfzyl to Emden steer southeastward between the buoys and round the Paap Sand South buoy, red and black striped, with cross, leaving it on the port hand, when an east course will lead across the bar into the dredged channel leading to Emden; the depths here, however, are subject to frequent change. In 1908 southward of the Paap Sand the depth at low water was 14½ feet.

By night.—If proceeding to Delfzyl from sea, the preceding directions should be followed until within the sector of fixed white light shown from Delfzyl lighthouse bearing 183°, and steering on that course, when Watum Light, which hitherto has been giving single white flashes, shows fixed white in a very narrow sector, alter course for it, steering 208°; to the eastward of the fixed sector the light will show double flashes. Continue on the latter course until the white light of Delfzyl, which has been giving quadruple flashes, changes to fixed, when steer for it 159°; shoreward of the fixed sector the light shows fixed red. Remain in the fixed white sector of Delfzyl Light until another fixed white sector of Watum Light is entered, which light kept astern bearing 325° leads to Delfzyl Road.

Proceeding from Delfzyl to Emden, steer to enter the southeastern fixed white sector of light from Delfzyl lighthouse and keep the light astern bearing 284° until Knock red light and G 5 occulting light buoy are in line 30°, when steer 33° until Emden Range Lights are in line, when proceed toward that place.

Eastern Ems.—Approaching the entrance from seaward, the old lighthouse tower and Great Beacon on Borkum Island in line, bearing 152°, lead to the distinguishing buoy (Oster Ems), thence a 123° course leads to the entrance of the channel, when the vessel must be directed by the buoys; between O D and O G buoys the red buoy side of the channel should be kept, the water being deeper on that side. Southeastward of O 4 black buoy a bar extends across the channel, with a depth of 16 feet at low water. Avoid the Konigs Flat southward of the Memmert Sand and do not get between the former and Lutje Horn. Eastward of the Konigs Flat the channel takes a southerly direction through the Wester Balje and into the main channel of the river, crossing the bar extending from the Randzel to Pilsumer Wad.

A vessel drawing 6½ feet, in charge of a pilot, can cross this bar at low water.

Ems River above Emden.—**Ditzum,** on the left bank of the Ems, about 4 miles above Emden, is a fishing port and customs station.

Leerort is a small fishing port on the right bank of the Ems at its junction with the Leda River, about 13½ miles above Emden. There is no accommodation for vessels, except the anchorage in the river and a quay.

Leer, on the Leda River, 2½ miles above Leerort and about 16 miles above Emden, can be reached at high water by vessels drawing about 18 feet. There is a quay on the river, 500 yards long, belonging to the railroad, and another below the town for small craft; also a wet dock 320 yards long, 80 yards wide, and 16½ feet deep, which is entered from a small tidal basin by a lock 50 feet wide. On the railroad quay there is a 15-ton crane and three smaller ones; the wet dock is provided with eight small cranes.

At high water vessels of 13 feet draft can ascend to Papenburg.

Dock.—(See Appendix.)

The town of Leer is an important port of transit. The exports consist principally of coal and iron from Westphalia.

Aspect of the coast—**The East Frisian Islands** comprise the low sandy islands Juist, Norderney, Baltrum, Langeoog, Spiekeroog, and Wangeroog. They lie at the average distance of 4 miles from the coast of Harlingerland and extend as a continuous chain in an easterly direction for the whole distance between the Eastern Ems and the mouth of the Jade. The spire of Esens Church, 194 feet in height above the ground, is a remarkable object and can be seen over Langeoog in clear weather.

The channels dividing these islands from each other and from the shore afford to the small craft of the country the means of communication between the Ems, the Jade, and Weser, for which class of vessels only they are available; most of them have distinguishing buoys (with the name of the channel on them) marking the approach to the several entrances. The channel over the Watts between the Ems and Jade Rivers dries in parts at low water and is marked by stakes, which should be left on the port hand when steering from west to east.

Small ports.—On the shore of the mainland abreast the islands are the villages of Norddeich, Nessmer Siel, Dornamer Siel, Benser Siel, Neuharlinger Siel (a lifeboat station), and Carolinen Siel or Friedrichsschleuse, which has a storm-signal and lifeboat station. The sands dry off to the islands, with narrow channels or gats only available at high water for boats or very small craft to the villages mentioned.

Norddeich, on the mainland abreast Norderney Gat, has a fishery harbor and is connected with the railway system. The outer approach from Norderney Gat is through the Busetief, which is buoyed on the uniform system and which is marked on the eastern side of the entrance by a black light and bell buoy No. 2, showing a group occulting red light. Nearer the town the channel, about 6 feet deep, is between dams which extend over 1.2 miles from the shore. There is a depth of 5 feet at low water alongside the railroad pier, on which are two 1-ton cranes.

Norddeich Lights.—Fixed white lights are shown at the outer and inner ends of the harbor pier and in line lead between the dams. A fixed red light is shown from an iron staging at the north end of the wooden pier or old eastern dam, at about 1 mile from the shore, and an occulting white light is shown from a gray scaffold at the north end of the extension of the western dam.

Time signals.—Radio time signals are issued at noon and midnight, Greenwich mean time. A weather report is issued at noon, Greenwich mean time. The station is open at all times to the general public. Call letters K A V.

Storm signals are shown here.

A lifeboat is stationed at Norddeich.

Radio.—A radio station, with an unrestricted public service day and night, has been established about 2 miles westward of the pier at Norddeich and about 400 yards inside the dike.

Juist, a low sandy island, forming the eastern boundary of the mouth of the Eastern Ems, is about 8 miles in length, ½ mile in width, and has on it two small villages in the center of the island. It is resorted to for sea bathing in summer. One mile southwest of its west end is the sandy isle named Memmert.

Juist Island—Beacons.—A square beacon, 43 feet high, surmounted by a cross, is erected at the west extremity of this island. On the east end is a beacon 33 feet high.

Memmert Island lies on the western end of the Nordland Sand, which is separated from Juist Island by the Juister Balje, a narrow channel with 1 to 6 fathoms of water, communicating with the sea at its western end, where there is a shallow bar, with a depth of 5 feet over it.

At the eastern end of Juister Balje is a staked channel over the sands, dry at low water, which forms the shortest route from Juist to Norderney and Norddeich. A similar staked channel across the Nordland connects Juister Balje with Memmert Balje at high water. Juist is the only one of these islands that can not be reached on foot.

Lifeboats—Beacon.—There is a lifeboat station on the west end of Juist and another at Ostdorf village. The village is connected with the telegraph system. On the southwest side of Memmert Island stands a beacon with ball as topmark.

Norderney, a low sandy island, the next eastward of Juist, is about 7½ miles in length and rather over 1 mile in breadth, with conspicuous white sand hills near the center and a village at the west end, where there are two buildings, each having a small steeple. The church is 65 feet high, but without a steeple.

On a hill near the west end of the island is a beacon, 36 feet high, surmounted by a black topmark which shows from northward and southward as a triangle with the apex downward and from the eastward and westward as a triangle with the apex upward, 134 feet above the sea. Close westward of it is a square tower 45 feet high, and south of it is a mill. The chimney of the electric works is conspicuous.

Norderney is a summer sea-bathing resort. During the season there is steam communication with Helgoland, Geestemunde, Cuxhaven, and Norddeich, and in winter with the latter place only. The island can be reached at low water by wheeled vehicles from the mainland. The post road to Hilgenrieder Siel leads across the Watt (flats) eastward of the lighthouse and is marked by a basket beacon.

At the village there is a harbor and a landing pier, where passenger steamers can lie alongside at low water. The speed of vessels near the entrance to the harbor must not exceed 3 knots an hour. There are two traveling hand cranes on the west pier, alongside which there are depths of between 8 and 10 feet at low water. Drinking water can be obtained. Vessels alongside the quay or at the dalben must show a bright light toward the harbor entrance from the center of the vessel on the channel side.

Telegraph cables are laid from the west end of the island to Juist and to the mainland at and eastward of Norddeich.

Life-saving stations.—There is a storm-signal station (night and day) and lifeboat at the west end of Norderney Island and a lifeboat on the northeast side of the island.

Norderney Lights.—From an octagonal lighthouse, painted red, 175 feet in height, near the center of Norderney is exhibited, at an elevation of 195 feet above high water, a flashing white light, visible 15 miles. The lighthouse is a telegraph and signal station.

Range lights are shown when the channels are practicable. A fixed red and green light and a white, red, and green flashing light are shown during summer for altering course through the channel and a front fixed white and a fixed white rear light for range lights through the Schluchter Channel. An occulting white, red, and green harbor light is shown from the west harbor dam, but is discontinued during the winter. White range lights are shown for the Dove Tief when the channel can be thus indicated. (See Light List.)

Tide.—The high water interval at Norderney is 11 h. 20 m.; springs rise 10 feet. (See General Tide Tables.)

Norderney Light Vessel (lat. 53° 56′ N., long. 7° 14′ E.).—This vessel is moored in 13 fathoms at a distance of 13 miles northward of Norderney Island Lighthouse, and exhibits a group flashing white light. The light is exhibited from a turretlike superstructure about 3 feet in diameter, painted yellow, situated between the two masts, and which has a special lantern with gallery round it, at an elevation of 52 feet above the sea, and is visible 12 miles. The vessel, which has two pole masts, is painted red and marked "Norderney" in white on her sides and stern. A short yellow funnel stands between the foremast and the yellow superstructure.

This vessel is provided with steam power, and, being over 150 feet in length, will carry two anchor lights, one forward the other, at the stern.

If the light vessel is out of position, the distinguishing light will be discontinued and by day a black flag will be shown from the gaff on the turretlike superstructure.

Should a vessel be seen to be standing into danger, guns will be fired and a bell rung and the usual International Code signals hoisted.

Fog signal.—During thick or foggy weather a siren (worked by compressed air) is sounded. The siren is 14 feet above the sea. During the silent intervals of the siren the ship's bell will be rung for a short period, followed by three strokes.

If the siren is disabled, a foghorn will be sounded.

Submarine fog bell.—In addition to the above-mentioned fog signals, a submarine fog bell has been established on board the Norderney Light Vessel.

Mariners passing this light vessel and desiring to acquire proficiency in receiving these submarine signals must hoist a white flag with a yellow bell. A similar flag will be hoisted on board the light vessel when the bell has been put in action and kept flying until it is discontinued.

Watch buoy.—A can buoy, painted in red, white, and black vertical stripes, is moored about 600 yards eastward of the light vessel.

A whistle buoy, striped red and black, and marked "Norderney," is moored in about 9 fathoms 4 miles 13° from the west end of Norderney Island. It is useful in hazy weather for keeping vessels off the shallow shore bank.

Norderney Gat is only available for small craft with local knowledge. There are at times two channels over the outer grounds—the western, named the Schluchter, and the Dove Tief—both of which lead into a channel with 6 and 8 fathoms close to the west side of the island. The former is closed. The Dove Tief varies in depth. The buoys are altered and at times removed to meet the frequent changes. They are removed when the depths are less than 6 feet.

Light buoys.—A red and black striped light buoy, exhibiting an occulting white light, is moored 3¼ miles northwestward of Norderney Lighthouse. This buoy is the fairway buoy for Dove Tief.

A black light buoy marked "D. 2," exhibiting a group flashing red light, is moored 2¾ miles northwestward of Norderney Lighthouse.

There are four red and two black spar buoys marking the channel. They are changed as necessary, as the channel changes.

Baltrum is a low sandy island about 3 miles in length and lies next eastward of Norderney. On it are two clusters of houses. There is a lifeboat on the southern side between the two villages.

Tide.—The high water interval at Baltrum is 11 h. 28 m.; springs rise 8 feet. (See General Tide Tables.)

The Wichter Ehe is a boat channel between Baltrum and Norderney, subject to change. At the inner end of Wichter Ehe a staked channel over the flat, dry at low water, connects with Nessmer Siel, on the mainland.

Langeoog—Aspect—Beacon.—Langeoog is a low and sandy island about 6 miles in length east and west and 1 mile in breadth at its widest part. The chief village is on the northwest side, near to which on the sand dunes is a black pyramidal beacon 46 feet high. The beacon is 96 feet above the sea. A brick water tower 60 feet in height is erected southwestward of the beacon. Near the church is a tower 75 feet in height.

Lifeboats.—There are lifeboat stations on the east and west ends of Langeoog.

Telegraph.—A telegraph cable is laid from Benser Siel on the mainland to the western part of Langeoog, whence it connects with the other East Frisian Islands. Its position is marked by green buoys.

Tide.—The high water interval at Langeoog is 11 h. 32 m.; springs rise 8 feet. (See General Tide Tables.)

Ackumer Ehe is the small craft channel with about 5 feet on its bar between Baltrum and Langeoog. The buoys are moved to meet the changes in the channel. A distinguishing buoy, red with ball, and marked "Ackumer," lies in 3½ fathoms in the approach to the bar.

A staked channel, dry at low water, connects the inner part of Ackumer Ehe with Benser Siel.

Otzumer Balje is the small craft channel with from 4 to 5½ feet on its bar between Langeoog and Spiekeroog. The buoys are moved to meet the changes in the channel. A red distinguishing buoy, with ball, and marked "Otz. Balje," lies in about 4 fathoms in the approach to the bar. A staked channel, dry at low water, across the sands, connects Schill Balje, the inner part of Otzumer Balje, with Neuharlinger Siel, on the mainland.

Spiekeroog is a low sandy island about 5.3 miles in length and about 1 mile in breadth, with sand hills on its western part, south of which is the village. The eastern part is only a few feet above high water. The northwestern dunes are conspicuous from their light color.

Near the southwest end of the island there is a landing pier, from which a tramway runs to the village. There is a telegraph cable to Neuharlinger Siel.

Beacon—Lifeboat.—A beacon stands on the easternmost sand hill, near the center of the island. There is a lifeboat station on the west side of the island.

Tides.—The high water interval at Spiekeroog is 11 h. 28 m.; springs rise 10 feet; on the mainland at Neuharlinger Siel, 11 h. 51 m., springs rise 6½ feet; and at Friedrichsschleuse, at 11 h. 00 m., springs rise 6 feet. (See General Tide Tables.)

Tidal currents.—In the several shallow and narrow channels, through the coast between the Ems and Weser Rivers, the current sets inward from six hours before to high water at Dover, and outward from high water at Dover to Six hours after.

The Harle is the small craft channel, with 5 to 6 feet on its bar, between Spiekeroog and Wangeroog. The buoyage is altered to meet the changes in the channel. The inner part of the Harle connects with Friedrichsschleuse by means of a staked channel, dry at low water.

A distinguishing buoy, red with ball, and marked "Harle," lies in 4½ fathoms in the approach to the bar.

Telegraph.—A telegraph cable is laid between Friedrichsschleuse and Wangeroog.

Weser Light Vessel (lat. 53° 54′ N., long. 7° 49′ E.), in the approach to the entrance of the Jade and Weser, is moored in 12 fathoms, 7.3 miles 338°. from Wangeroog Lighthouse.

The vessel has three masts, is painted red, with "Weser" in white letters on sides, and carries a red cage at each masthead.

Three fixed white lights are exhibited, one on each mast, at 39 feet above the sea, visible 10 miles.

A riding light is hoisted on the forestay, and when the vessel is out of position the lights will not be shown, and a black flag will be hoisted at the gaff by day.

When vessels are observed steering a dangerous course a bell will be rung, a gun will be fired, and the signal J D of the International Code hoisted, signifying, "You are standing into danger." The light vessel is liable to be removed for short periods for repairs, without any substitute. A red spar buoy is charted ¼ mile southward of the light vessel.

Fog signal.—During thick or foggy weather a siren is sounded. The fog bell will be struck loudly five times at short intervals in each group of the signals.

A submarine fog bell on board the Weser Light Vessel will be sounded in thick or foggy weather. (See Light List.)

Storm signals.—Storm signals will be shown from the light vessel by ball, cones, and red flags during the day, and by a red light, exhibited at the yard of the mainmast at night.

Radio signals.—The Weser Light Vessel is fitted with a radio installation. Messages can be received by International Code, etc., and forwarded to their destination by telegraph. Radio messages only received from vessels in distress; call letters, F W F.

Tides.—The high water at Weser Light Vessel is 11 h. 27 m.; springs rise 10½ feet.

Tidal currents.—At Weser Light Vessel the flood current, general direction 116°, runs from five and a quarter hours before, till one hour after high water at Dover; its greatest velocity is at two and one-half hours before high water at Dover, at which time the mean velocity at springs is 1¾ knots and at neaps 1¼ knots; the greatest velocity ever observed at this time was 2 knots.

The ebb current, general direction 291°, runs from one hour after till five and a quarter hours before high water at Dover; its greatest velocity is at four and one-half hours after high water at Dover, at which time the mean velocity at springs is 1½ knots and at neaps 1¼ knots; the greatest velocity ever observed at this time was 2 knots.

From five and one-half hours till four hours before high water at Dover the current is irregular; the actual duration of slack water is, however, short.

Aussen Jade Light Vessel (lat. 53° 52′ N., long. 7° 57′ E.), the outermost of the river light vessels, is moored in the entrance to the Alte Jade, at nearly 4½ miles, 20°, from Wangeroog Lighthouse, and 123°, 5 miles from the Weser Light Vessel.

The vessel has three masts, is painted red, with "Aussen Jade" in white letters on the sides, and carries a black ball on the fore and main masts.

A fixed white light is exhibited from the fore and main masts at 34 and 55 feet above the water, respectively (26 and 41 feet in bad weather), visible 9 miles. A riding light is carried on the forestay. This light vessel may be passed on either side.

In the absence of the pilot vessel, pilots may be obtained from the light vessel, their presence on board being indicated by the pilot flag hoisted at the mizzen gaff.

If the light vessel be out of her position, no balls or lights except the riding light will be exhibited, but a black square flag will be hoisted at the mizzen.

Vessels steering a wrong course will be warned of their danger by the firing of two guns every three minutes, sounding the bell, or by signals of the International Code, and the proper course will be communicated when possible.

The light vessel is liable to be moved from her station for short intervals without notice.

Fog signal.—A steam foghorn on board the light vessel is sounded. If the foghorn be disabled, a bell will be struck.

Submarine fog bell.—During thick or foggy weather a submarine bell on board the light vessel will be struck.

Radio signals.—The light vessel is fitted with a radio installation and is a signal station (day and night). Messages are received from vessels by International Code, etc., and forwarded to their destinations by telegraph. Communication with the light vessel by means of radio, from vessels fitted with the apparatus, should be confined to cases of vessels in distress; call letters, F A U.

Tidal currents.—At Aussen Jade Light Vessel the flood current, general direction 138°, runs from four and three-quarters hours before till one and one-half hours after high water at Dover; its greatest velocity is from three to two and one-half hours before high water at Dover, at which time the mean velocity at springs is 2½ knots, and at neaps 1¼ knots; the greatest velocity ever observed at this time was 5½ knots.

The ebb current, general direction 318°, runs from one and one-half hours after till four and three-quaters hours before high water at Dover; its greatest velocity is from three and one-half to four hours after high water at Dover, at which time the mean velocity at springs is 2½ knots, and at neaps 1¼ knots; the greatest velocity ever observed at this time was 4 knots.

Pilots.—A pilot vessel for the Jade cruises by day between the Weser and Aussen Jade light vessels and by night as far as possible within sight of the Weser Light Vessel. The pilot vessel is painted black, is schooner rigged, carries no foretopmast, and has no mark on the sail. By day she carries the imperial service flag at the mainmast and by night a white light at the masthead; no side lights are shown. When in her station, two long flares are shown in quick succession every 15 minutes. This distinguishes her from the pilot vessels of the Weser and Elbe, those of the Weser showing one flare of longer duration and those of the Elbe three flares in quick succession every 15 minutes. The steam pilot vessel Jade has a radio installation; call letters, J A.

In the absence of the pilot vessel Jade pilots may be obtained from the Aussen Jade Light Vessel, and in bad weather from the Minsener Sand Light Vessel also. The German pilot flag is hoisted at the mizzen gaff by day when there are any on board; by night ships which on approaching desire a pilot receive as reply the same flare signal as shown from the pilot vessel.

Pilotage in the Jade River is compulsory, both inward and outward, for all merchant vessels of 500 registered tons and upward and for foreign vessels of war.

An outgoing vessel from the Jade wishing to drop her pilot hoists the pilot flag at the foretop and at night shows a blue light. As reply that the pilot will be taken off, the Aussen Jade or Minsener Light vessel will hoist a red flag at the foreyard by day and show two long flares in quick succession at night.

If, on account of bad weather or other reason, the pilot can not be taken off, the red flag will be hoisted halfway up by day and a red light will be shown 5 feet above the riding light at night.

Caution—Buoyage.—The sands at the entrance as well as in the Jade and Weser are constantly changing. The channels are buoyed in accordance with the German uniform system, and the buoys are shifted as necessary, so that the directions given should be used with caution, and no stranger should enter the river without a pilot. Gas buoys are used in certain places for night navigation.

Wangeroog.—The mouths of the Jade and Weser are bounded to the westward by Wangeroog, a low, sandy island and the easternmost of the East Frisian Islands. It is about 5 miles in length by ¾ mile in breadth. The northern shore is protected against the action of the sea by a number of stone groins.

A village formerly stood upon the west extremity of the island, and the tower of its church, 177 feet high, still standing, but surrounded by water at high tides, is one of the most prominent objects upon the coast; but the village has gone. The tower is quadrangular, of bright red stone, with three turrets and a slate roof.

Near the southwest end of the island and at the eastern end near Strand Beacon are landing piers for steamers, connected with the village by railway. A tide-gauge house on piles stands near the eastern of these, which has the greatest depth alongside at high water. There is a motor-boat ferry to Carolinen Siel, and in summer steam communication with Wilhelmshaven and the chief towns on the Weser River. There is telephonic communication with the mainland; also with Spiekeroog, Norderney, and Borkum.

Wangeroog Lighthouse, a red brick circular tower, 103 feet high, near the eastern end of the island, exhibits at an elevation of 100 feet above high water a fixed and group flashing light, with white and red sectors; the white sector is visible 16 miles and the red sector 12 miles.

An auxiliary light, fixed white, visible 9 miles, is shown 19 feet below the main light.

Fog signal.—During thick or foggy weather the fog siren, established ¼ mile northward of the lighthouse, is sounded.

Signal and life-saving stations.—The lighthouse is a telegraph and signal station connected with the signal stations on the mainland. Vessels can communicate by the International Code and be reported or messages sent at a fixed charge, payable by the receivers; also at Schillighorn in the river.

Storm signals are shown from a signal station near the fog siren station near Dunen Beacon.

Lifeboat.—There is a lifeboat at the east end of the island.

Beacons.—Dunen Beacon, 50 feet in height, is situated on the sand hill northward of Wangeroog Lighthouse, near the signal station.

Strand Beacon is situated at the eastern end of Wangeroog, nearly 2½ miles, 105°, from the lighthouse, and on the west side of entrance to the Blaue Balje; it is in the form of two cones, like an hourglass.

On the sands extending northward of Schillighorn are two beacons; the farthest, with a triangular summit and vane on the Minsener Old Oog, is a rescue beacon; it lies 5 miles, 112°, from Wangeroog Lighthouse. A pile beacon with dwelling room, 28 feet in height, surmounted by a mast 26 feet in height, stands 450 yards southwestward of the latter beacon.

Mellum Beacon, on the west side of Alte Mellum Sand abreast Schillig in the Jade, is 62 feet high and built of wood in the shape of a pyramid. The upper part is covered with laths, forming a rescue station.

Ice signals.—Signals are hoisted from the signal station on Wangeroog, signifying the condition of the ice in the Jade River to Wilhelmshaven. The signals are made with a ball, a drum, and a cone, and can be seen from between the bearing of 147°, round by south, to 213°.

Signal.	Signification.
A cone, point down, over a ball	Ice moving everywhere; the harbor entrance of Wilhelmshaven is impracticable.
A drum	Ice moving everywhere; the entrance of the port is practicable, but the lock gates impracticable.
A drum over cone with the point down.	Ice moving everywhere; the entrance to the port and lock gates practicable.
A ball over a drum	Ice moving in the river; the entrance of the port impracticable.
A ball over a cone with the point up.	Ice moving in the river; the entrance of the port is practicable, but the lock gates impracticable.
A drum over a ball	Ice moving in the river; the entrance of the port and lock gates practicable.
A drum over a cone with the point up.	Little ice in the river; the entrance of the port impracticable.
A cone with the point up, above a ball.	Little ice in the river; the entrance of the port practicable, but the lock gates impracticable.
A cone with the point up, over a drum.	Little ice in the river; the entrance of the port and lock gates practicable.
A ball over cone with the point down.	No more ice.

The first of the above signals is also made at Schillighorn.

Ice signals are also shown from the old church tower near the west end of Wangeroog, indicating the condition of the ice in the Weser.

Signal.	Signification.
One black ball	Drift ice in the Weser, though entrance is practicable, with caution.
Two black balls	Much ice in the Weser (navigation near Bremerhaven interrupted by ice); Bremen Light Vessel is not in station.

Jade and Weser—Outer buoyage.—The distinguishing buoys marking the seaward side of the dangerous flats in the approach to these rivers, which are more or less permanent, and a guide to vessels approaching them, will be mentioned here.

Jade.—The Jade distinguishing buoy is a black and white checkered bell buoy, marked "Jade," moored in about 8 fathoms, about 1 mile 298° of the 5-fathom western edge of Jade Plate, or flat, and midway between Weser Light Vessel and Wangeroog Lighthouse.

The western end of Jade Plate is marked by a white buoy, Jade Plate W, with topmark consisting of two triangles, points together, lying 118° about 1 mile from the Jade Bell Buoy. The outer black fairway buoy of the Wangeroog Channel, showing a group flashing white light, lies 140° 1.3 miles from the bell buoy and ½ mile southwestward of the western Jade Plate Buoy.

The northern side of the Jade Plate is marked by a white buoy, Jade Plate N, with topmark consisting of two triangles, points upward, lying 90° nearly 3½ miles from the Jade Bell Buoy and 1 mile southeastward of Aussen Jade Light Vessel.

Alte Jade and Weser.—Schlüssel (Key) Buoys are two red buoys, moored near each other, in about 9 fathoms, in the common approach to the Alte Jade and Weser mouths, 8° about 4½ miles from Wangeroog Lighthouse and about 2 miles 67° of the Jade Bell Buoy.

The inner buoy is a spar buoy, and both are surmounted by a gilded key over a ball. The outer buoy is marked "Weser" and the spar buoy is marked "A."

Alte Weser.—At about 1 mile northwestward of the 5-fathom western end of Roter Sand is a red distinguishing buoy surmounted by a diamond and marked "Alte Wsr."

The western end of the Roter Sand is marked by a black beacon buoy marked "1," surmounted by a mirror, also a square flag marked "1," moored in 5½ fathoms at low water.

Norder Gründe, a white buoy, marked "Nordergründe W.," and surmounted by mirror, also two triangles, points together, lies in 8¾ fathoms, about 1 mile westward of the western extremity of the Norder Gründe. This buoy is in position from April to September.

Wester Till, a white distinguishing buoy, marked "Wester Till N.," and surmounted by a ball with two triangles, points upward, above it, is moored in about 12 fathoms, at about 1½ miles 33° from the north extremity of the western 2¾-fathom patch on the Norder Gründe. A black whistle buoy, also marked "Wester Till N.," lies a short distance westward of the Wester Till Buoy.

Scharhörn, a white distinguishing buoy surmounted by two triangles, points upward, and marked "Scharhörn N.," is moored in about 12 fathoms, at 3½ miles 75° from the Wester Till and 2½ miles 233° from the Elbe Outer Light Vessel.

Caution.—Red buoys, for dredging purposes, are from time to time laid out in the Jade. Mariners must be careful not to mistake these buoys for the red buoys marking the starboard side of the channel.

General remarks—Banks.—Two middle grounds or sands, of which Jade Plate is the westernmost, separate the mouth of the Jade from that of the Weser.

The western side of the channel of the Jade is formed by the projection of the sands eastward, dry at low water, between Wangeroog Island and Schillighorn on the main, named Minsener Old Oog and Neue Brack; near the edge of the former of which are two rescue beacons. Southward of Schillighorn the channel is confined between flats fronting the west shore, and Alte Mellum and Hohe Weg flats and Solthorner Watt, the two former of which extend about 13 miles northward of Butjadingen, eastward of which is the Weser.

Projecting from the flats on the west side of the river are H Plate, a shallow flat between the Minsener Old Oog and the Minsener channel; the Voslapp Plate, a long spit, dry at low water, which extends northward from abreast Voslapp to abreast Hooksiel; and the Heppenser Plate, with but little water on it, which also extends northward and lies about 1½ miles from Wilhelmshaven.

Shoals.—Southward of H Plate and on the western side of the main channel several shoals of less than 4¼ fathoms have been reported, extending between red light buoy No. $\frac{8}{9}$ and black light buoy No. 9.

Submarine cable.—Minsener Old Oog is connected with the mainland by a submarine telegraph cable, which is laid through Legde Watt Fairway and marked by green buoys inscribed "Telegraph."

Channel.—Between the shoals extending northward from Minsener Old Oog and H Plate there is a buoyed channel with a depth of 26 feet in the northern part.

Piers.—A pier 1,150 feet long, extending eastward from the Rescue Beacon, is in course of construction at Minsener Old Oog. The north extremity of this pier is marked by a small red buoy.

Extensive wharves, in connection with the imperial dockyard at Wilhelmshaven, are being constructed on Minsener Old Oog, the low-water northern extremity of which sand is marked by five pole beacons surmounted by brushwood.

(No information has been received as to the completion of these piers, but having been started in 1912, it is probable that they are completed.)

Deposit ground.—Northward of the Heppenser Plate, toward the edge of the Watt, is a deposit ground for dredges, marked by two red spar buoys. Farther northward, toward the edge of Voslapp Watt, abreast of Genius Bank Light Vessel, is a similar ground, marked by a red spar buoy with red flag.

A spoil ground, marked by a black barrel buoy, with flag as topmark, is established at 2½ miles eastward of Minsener Old Oog Rescue Beacon.

A spoil ground, marked by a red spar buoy, with flag as topmark, is established off Voslapp Watt, at about 1.8 miles south by westward of Genius Bank Light Vessel.

Middle Grounds are the Jade Plate or Flat, already mentioned, separated from the Minseners and southeast of it by a narrow unbuoyed channel, and both banks subject to frequent change in shape and depth of water; the Hooksiel Plate, on the east side of the channel, has about 3 fathoms at low water near its west edge; and the Genius Bank in mid-channel, abreast Sengwarder Balje, with 7 feet least water.

Weser Fahrt is a channel between the Jade and the Weser, leading over the ridge connecting the Roter Grund and Mellum Plate. It is available for vessels of light or medium draft, according to the state of the tide and the heavy ground swell.

Sengwarder Balje is the western entrance to a Watt Channel leading over the sands to Hohewegs Balje in the Weser River.

Several small harbors on the west side of the rived below Wilhelmshaven are approached over the flat by staked channels; the most important of these is Hooksiel.

Tide gauges.—Tide gauges have been established at the following places: In the Schweiburger Balje; on the edge of the reef between Hooksiel and Creldumersiel; on the Hoheweg Reef, eastward of Hooksiel Plate; eastward of Minsener Old Oog Rescue Beacon; and in Mittelbalje, southward of Wangeroog.

The entrance channel between Jade Plate and the Minsener Sand on one side and the Roter Grund northward of Jade River entrance on the other, is known as the Alte Jade and is the principal channel in the river at present, but the depths frequently change, so that those shown on the chart, inside or outside the line of buoys, must not implicitly be relied on. The alternative channel is the Wangerooger.

Jade Bay.—Just above Wilhelmshaven the shores of the Jade recede and form Jade Bay, a shallow circular basin about 9 miles wide; the source of the river is near Rastedt, 15 miles above it.

The whole length of the Jade may be assumed as 50 miles.

Buoyage.—In the Wangeroog Channel and its continuation by the Minsener Channel to Wilhelmshaven the starboard or red buoys entering are marked by letters and the port or black buoys by numbers, the outer buoys being marked " A " and " 1," respectively.

Of the black buoys, nine are light buoys. In the Wangeroog Channel Nos. 1 and 4 exhibit a group flashing white light, showing a group of 2 flashes every 12 seconds; No. 5 shows a similar light with a group of 4 flashes every 18 seconds; No. 8, at the junction of the Minsener Channel and Alte Jade, exhibits a group flashing white light, showing a group of 2 flashes every 18 seconds; No. $\frac{8}{9}$ buoy, about 1¼ miles southward of No. 8, shows a group flashing red light with a period similar to No. 8; No. 9 shows a group flashing white light, with a group of 4 flashes every 18 seconds; and No. 13, at the west edge of Hooksiel Plate, shows a group flashing white light, similar to No. 8. No. 16, a black spar light buoy, moored nearly ½ mile northeastward of the Genius Bank, shows a group flashing white light, with groups of 2 flashes every 12 seconds—thus: flash 1½ seconds, eclipse 2½ seconds, flash 1½ seconds, eclipse 6½ seconds. No. 21 lies about 2 miles northeastward of Wilhelmshaven, and in summer only exhibits a group flashing red light showing a group of 2 flashes every 18 seconds. Z, a red light buoy lying in Wilhelmshaven Road, in 7 fathoms, exhibits an occulting white light every 8 seconds—thus: light 4 seconds, eclipse 4 seconds.

Blaue Balje, a channel leading southwestward from the eastern part of the Wangerooger Channel into the Neue Brack Sand, passing between the Strand Beacon and Minsener Old Oog Sand, is buoyed on the uniform system for a distance of 1¾ miles inside the fairway buoy, which is red and black and marked " Blaue Balje."

The bar at the entrance to this channel has shoaled considerably and can not be crossed in a heavy sea.

The buoys are shifted as required.

Alte Jade.—The starboard side of the channel, entering, is indicated by six buoys, marked "AJ/A," "AJ/B," consecutively; AJ/C off the north end of the Minsener Sand is a light buoy, showing an occulting red light every 8 seconds—thus: light 4 seconds, eclipse 4 seconds. AJ/F is a red and black horizontally striped beacon buoy, with staff and triangle, moored in 6 fathoms off the south end of the Minsener Sand, at the junction of the Minsener and Alte Jade channels.

The three black conical buoys on the port hand entering are marked "AJ/1," etc., consecutively. No. 1, the outer, is a light buoy exhibiting a group flashing white light showing a group of 2 flashes every 18 seconds.

During winter, while ice is formed, light buoys are replaced by spar buoys and conical buoys according to the side of the channel they are on, with the exception of No. 16, which is not replaced. With the exception of some of the outer buoys, beacon buoys are replaced by spar buoys, and the topmarks of nearly all spar buoys are removed before the formation of ice. The buoys marking telegraph cables on the Watts are replaced by wooden floating beacons.

Navigable depths to Wilhelmshaven.—The least depth between the sea and Wilhelmshaven, entering by the Alte Jade, the principal channel, is about 25 feet at low water and 34 feet at high water springs. It is found on the bar southward of Minsener Light Vessel.

The buoyed channel of the Alte Jade has 4¼ fathoms least water at low and about 5¾ fathoms at high water springs.

The bar of the Wangeroog. the alternative channel, situated about 3 miles inside the two outer channel buoys, has a depth of 3¾ fathoms at low water springs.

A shoal with a least depth 3¾ fathoms over it has been discovered in Wangerooger Channel, in latitude 53° 48′ 57″ N., longitude 7° 57′ 50″ E.

The bar southward of Minsener Light Vessel had less than 4¼ fathoms and the bar of the channel eastward of Genius Bank Light Vessel from 4½ to 5 fathoms; elsewhere the water is deeper, subject to change.

Off Wilhelmshaven there are depths of 5 to 9 fathoms. Springs rise 10½ feet at Wangeroog and 13¾ feet at Wilhelmshaven.

Wilhelmshaven is about 25 miles above the Aussen Jade Light Vessel.

Lifeboats.—There are lifeboats stationed at Horumersiel and Hooksiel, southward of Schillighorn, and at Wilhelmshaven.

The Aussen Jade, Minsener Sand, and Genius Rock light vessels are provided with lifeboats.

Ice.—In the Jade the formation and the disappearance of ice is very uncertain. The channel of the Jade never freezes completely over, and there have been years when there was no ice. As a rule, the first appearance of ice is from the end of November to the middle of December, and no ice is expected to be in the river after March 1. In general, it may be said that the ice in the Jade does not necessitate a closing of its navigation for any length of time.

Observations extending over a period of eight years show that on an average, ice appeared during the winter months on 13 days in the Inner Jade and on 15 days off the entrance to Wilhelmshaven.

Schillighorn Lighthouse, a brown cylindrical tower, 76 feet in height, stands on Schillighorn, the northeast point of Jever, western shore of the Jade and exhibits, at an elevation of 69 feet above high water, a fixed light, with red and white sectors, visible 12 and 14 miles, respectively.

From the same tower, at a height of 59 feet above high water, a fixed, flashing, and group flashing white light is exhibited, visible 13 miles.

Beacon light.—From a beacon, situated about 1,750 yards 23° from Schillighorn Lighthouse, is exhibited a group occulting white light.

This light, intensified over an arc of 4° on each side of its alignment with Schillighorn Light, is elevated 22 feet and visible 10 miles in the intensified sector.

Signal station.—There is a signal and telegraph station on Schillighorn.

A cone, point down, above a ball hoisted at the masthead of the signal mast signifies that there is floating ice in the channel, and that entry to Wilhelmshaven is impracticable.

Tide gauge.—A tide gauge has been established, in a depth of 19 feet, near the edge of the bank eastward of Schillighorn, the position of which is marked as follows: A wooden pile, with drum topmark, close to the gauge; a green barrel buoy, marked "Pegel," about 50 yards northward from the gauge; and a similar buoy about 50 yards southward from the gauge.

Hooksiel Light, fixed white, elevated 27 feet above high water, and visible 6 miles, is shown from a gray circular pillar situated near the canal entrance.

Voslapp Lighthouse, a tapering black square skeleton tower, standing on four legs, with black lantern, is erected on the Watt near Voslapp and exhibits, at an elevation of 65 feet above high water, a fixed red and white light and a group flashing white light.

Fog signal.—During thick or foggy weather a bell will be struck.

Sengwarder Balje Light, exhibited from a black beacon on the north side of the entrance to Sengwarder Balje, eastern side of approach to Wilhelmshaven, and bearing 84° 1½ miles from Voslapp Light, is a group occulting light, with white and red sectors, at a height of 22 feet above high water.

River light vessels.—During the winter months the light vessels, in consequence of the ice, are liable to break adrift or to be temporarily removed.

Minsener Sand Light Vessel (lat. 53° 49′ N., long. 8° 05′ E.) is moored about 1,300 yards eastward of Minsener Sand and 116° 5.3 miles from the Aussen Jade Light Vessel; the channel is westward of her. The vessel is painted red, with the words "Minsener Sand" in white letters on her sides, and has three masts with a black ball at each masthead.

Three fixed white lights are exhibited, one on each mast, elevated, respectively, 47, 36, and 24 feet above the sea and visible 9 miles. During bad weather the two lights 47 and 36 feet above the water will be lowered to heights of 39 and 29 feet, respectively; a riding light is shown.

As a warning to vessels steering a dangerous course, two guns will be fired every three minutes, a bell rung, or flag signal hoisted.

If the vessel is out of position, no light, except the riding light, nor ball will be shown, but a black flag will be hoisted at the mizzen.

Fog signal consists of an explosive signal.

The light vessel is a pilot station in bad weather; a lifeboat is carried.

Night signals.—Minsener Sand and Genius Bank light vessels are night signal stations.

Genius Bank Light Vessel (lat. 53° 35′ N., long. 8° 11′ E.), moored in 29 feet of water, marks the southeast end of Genius Bank, about 3½ miles below Wilhelmshaven. The vessel has three masts, is painted red, with "Genius Bank" on her sides in white letters, and carries a black ball on the mainmast; a riding light is shown.

A fixed white light is shown from the masthead at an elevation of 39 feet above the sea (26 in bad weather), visible 8 miles.

As a warning to vessels steering a dangerous course, two guns will be fired every three minutes, a bell rung, or a flag signal hoisted.

If the vessel is not in station, no light, except the riding light, nor ball will be shown, but a black flag will be hoisted at the masthead.

In winter, when the light vessel is withdrawn, its position is marked by a black conical buoy.

Fog bell.—In thick or foggy weather a siren will be sounded. Should the siren be disabled, a bell will be struck.

A lifeboat is carried. The light vessel is liable to be withdrawn occasionally.

Eckwarderhorn Light.—From a black scaffolding, erected at the end of a dyke on the east side of the river, at 3½ miles southward of Genius Bank Light Vessel, is exhibited, at an elevation of 16 feet, a fixed white light, with red and green sectors.

This light is occasionally extinguished.

Schillig Road, eastward of Schillighorn, affords anchorage well sheltered against all winds, excepting those from northwest by north through north to northeast by north.

There are mooring buoys, painted gray, for the use of torpedo boats, in the western part of the road.

Measured mile.—A distance of 1 nautical mile is marked in Schillig Road by two red spar buoys N and O. The course to be steered is 350° or 170°. The northern buoy (N) is moored on the alignment of Stumpenser Mill and a beacon with triangular topmark erected on the Groden to the southward of the lighthouse. The southern buoy (O) is moored on the alignment of two beacons, 1,312 yards apart, situated on the sands to the southward of Horumersiel. The western beacon has a square and the eastern beacon a triangular topmark. These beacons are removed in the winter.

Anchorage.—From Horumersiel upward there is good anchorage within the range of Hooksiel Light, and nearly everywhere except during gales from the northward.

Tides and tidal currents.—The high-water interval at Wangeroog west is 11 h. 14 m.; springs rise 10½ feet and neaps 9½ feet.

At Wangeroog east the high-water interval is 11 h. 28 m.; springs rise 11¼ feet.

At Hooksiel springs rise 11¾ feet.

At Wilhelmshaven the high-water interval is 0 h. 3 m.; springs rise 14 feet.

The tidal currents generally follow the direction of the channels. In the Alte Jade, between the light vessels, the flood inclines toward the Jade Plate and Minsener Sand and the ebb toward the north side of the channel. In the Wangeroog Channel the currents set in the direction of the fairway, except abreast of the Blaue Balje, where they are influenced by the tide setting into and out of that channel, so that care is necessary in this part, also near light buoy No. 5, where the first of the flood sets more easterly than the direction of the channel.

Between buoys Q and S both currents set obliquely across channel. In the northwestern part of the Minsener Channel the currents attain a velocity of from 1¼ to 2½ knots an hour. The greatest velocity of the flood current in westerly gales was observed to be 5½ knots, and of the ebb, after a continuance of fresh westerly winds, nearly 4 knots.

Near the Genius Bank Light Vessel the flood and ebb currents attain a maximum velocity of 2¾ and 3 knots, respectively.

Wilhelmshaven, the principal German naval station on the North Sea, is situated on the left bank of the Jade River, 25 miles above the entrance. It is of little commercial importance and exists for the naval dockyard and arsenal.

Anchorage.—The best anchorage is found to the eastward of Z light buoy in 6 to 9 fathoms.

Small vessels can anchor nearer the shore during westerly winds in 4 to 5 fathoms, but they must not anchor in such a position as to obstruct the entrance to the port.

Anchorage is forbidden within 400 yards of any ship of war at anchor in the road.

Explosives.—Vessels laden with powder or explosives must hoist a red burgee (flag B of International Code) at the masthead and must anchor at least 200 yards distant from other vessels.

Basin—Docks.—The entrance to the Government wet dock or basin admits vessels of 29 feet draft of water and 70 feet beam.

There are six large graving docks; also a smaller one capable of taking large torpedo craft.

The floating sheers will lift a weight of 50 tons.

In addition to the Government naval establishment at Wilhelmshaven, there is a commercial port, consisting of a tidal basin and wet dock, at the head of which is the entrance to the Ems-Jade Canal.

Wilhelmshaven—Docks.—(See Appendix.)

Harbor lights—First harbor entrance.—A fixed white light is exhibited, at a height of 38 feet, from the end of the north mole, and a fixed red light, at a height of 23 feet, from the south mole. Also a fixed green light is exhibited, at a height of 23 feet, at the bend of the north mole.

Two red range lights indicate the lock entrance to the new harbor.

Second harbor entrance.—A fixed green light is exhibited, at a height of 32 feet, from an iron standard, on the north mole, and a fixed light with white and red sectors, at the same height, from a similar support on the south mole.

Fog signal.—A fog bell is sounded from the north pier.

Third harbor entrance—A fixed light, with white and green sectors, is exhibited, at a height of 42 feet, from a gray hexagonal tower on the head of the north pier, and a fixed light, with white and red sectors, at a height of 72 feet from the head of the south pier.

Fog signal.—A foghorn is sounded from the north pier.

Light buoy.—A buoy showing an occulting red light every 8 seconds is moored on the southeast side of the approach to Wilhelmshaven, opposite the second entrance. It is replaced in winter by a black conical buoy.

Coal.—A large quantity of coal is kept here for Government use.

Time signal.—The time signal is exhibited at the third harbor entrance on the northern side of the entrance to Marien Tief, 112 feet above high water and 95 above the ground, a black ball 5 feet in diameter will be hoisted halfway up at 10 minutes before the signal is made and close up at 3 minutes before. The ball will drop at noon, mid-European mean time (fifteenth meridian), corresponding to 23 h. 00 m. 00 s., Greenwich mean time; also at 1 h. 00 m. 00 s., mid-European mean time, corresponding to noon, Greenwich mean time. The local mean time at which the ball is dropped is 11 h. 32 m. 37.5 s. a. m., and 0 h. 32 m. 37.5 s. p. m. Should the signal fail, a red ball is shown until the black ball is lowered.

The time signal can be obtained by telephone day or night from the observatory.

Hospitals.—There is a hospital for infectious diseases, a naval hospital, and a municipal hospital.

Storm signals—Lifeboat.—Storm signals are shown when necessary, both day and night, at the second harbor entrance. There is a lifeboat station at Wilhelmshaven.

Arngast Sand Light.—From a circular lighthouse with two galleries, 113 feet in height, painted red, with a broad white band, and having the lower gallery white, erected on Arngast Sand, is exhibited fixed flashing and group flashing light with white and red sectors, elevated 99 feet and visible 16 miles.

An auxiliary fixed light with white, red, and green sectors is shown from the same tower at an elevation of 100 feet, and is visible over Jade Bay 6 miles.

Dangast Light.—From a pole, situated on a dune at Dangast, 4 miles 179° of Wilhelmshaven, is exhibited a fixed white light, elevated 28 feet and visible 6 miles.

This light is shown from March 1 to May 18 and from August 1 to November 30.

Directions.—In consequence of the frequent changes in the channels, shifting of buoys, and amendment of light sectors, strangers and vessels of war must employ a pilot. Vessels entering without a pilot in cases of emergency must be governed by the buoys and lights as they find them.

Prohibited anchorage.—Anchorage is prohibited in the southern part of Wangerooger Channel and between a line joining Wangeroog and Roter Sand lights and Roter Sand Light and the Strand Beacon eastward of Wangeroog; also for some distance on either side of a line joining Jade Plate Buoy and the Weser Schlussel Buoys, as telegraph cables are laid in those localities.

Weser River—General remarks.—The Weser is formed by a junction of the Fulda and Werra, near Munden, on the former frontiers of Hanover and Hesse-Cassel; traverses circuitously, generally toward the north, through small portions of the territories of Hesse-Cassel, Westphalia, and Brunswick; forms the boundary between Hanover and Oldenburg, and has a wide and sand-encumbered estuary. The whole course of the Weser is 250 miles in length; it receives several affluents, and in the lower portion of its course is strongly embanked to protect the country from inundation.

Entrances.—The main channel into the Weser is between Roter Sand and Tegeler Flats on the northeast, and Jade Flat, Roter Grund, Mellum Flat, Alte Mellum, and Hohe Weg Flat to the southwestward. Eastward of Roter Sand is the Alte Weser, which crosses the flat connecting Roter Sand with Tegler Flats and joins the principal channel at about 1½ miles southeastward of Roter Sand Lighthouse.

Navigable depths to Bremerhaven and Bremen.—The least depth between sea and Bremerhaven that must be passed over is 4 fathoms at low water and 5¾ fathoms at high-water springs, and is found at the western end of Dwars Gat.

A patch of 3¼ fathoms at low water lies abreast of No. 18 buoy in the Wurster Channel, and others of 3 to 3¼ fathoms extend from the east bank into mid-channel between Nos. 23 and 24 buoys, and also between Nos. 1 and 2 beacons between the Brinkamahof Forts.

Vessels of heavy draft when navigating Wurster Channel must keep well to the westward of the line formed by black conical buoys Nos. 17, 18, and 19.

A vessel of 30 feet draft can navigate the channel from sea to Bremerhaven at high-water neaps and of 20 feet draft at low-water springs in charge of a pilot. The outer bar is abreast and south of Roter Sand Lighthouse.

Patches of 3 and 4 fathoms, which are composed of accumulations of mussels and are removed by dredging as soon as discovered, lie on the northern side of the fairway to a distance of nearly ½ mile southward from Roter Sand Lighthouse, and there is a depth of about 4½ fathoms 900 yards from the lighthouse, between it and red buoy D. There are shallower bars at the west end of the Dwars Gat and off Wremen and Weddewarden, all subject to change.

Off Bremerhaven there are depths of 5¼ to 7 fathoms. Strong easterly winds may possibly decrease the depth to Bremerhaven by about 4 feet.

Vessels of 24 feet draft can ascend to Brake, 14 miles above Bremerhaven, and of 18 feet draft to Bremen, 35 miles above Bremerhaven, and 68 miles above the entrance at ordinary high water, unless the river is below its normal height, caused by winds, etc.

It is stated that vessels of 24½ feet draft can ascend to the Weser Yard, 2½ miles below Bremen.

Caution—Buoyage.—The Weser, particularly during the winter months, like all rivers on this coast, is liable to silt up, causing the channels to alter considerably. The channels are buoyed in accordance with the German uniform system, but no stranger should enter without a pilot. The outer buoys have been referred to elsewhere.

In the main ship channel the starboard-hand buoys on entering are red spar buoys and those on the port hand black conical. Channels other than the above, and also the river between Grossensiel and Bremen, are marked in a similar manner on the port side entering, but the starboard side is marked by red can buoys.

Red or starboard-hand buoys are marked by letters A—Z and black or port-hand buoys by numbers. The numbering is consecutive from sea up to above Grossensiel, and the lettering is divided into two series, the second commencing 3 miles below Bremerhaven and continuing to above Grossensiel, where a fresh series begins with the altered type of buoy, and continues as far as Brake.

Light buoys.—The following light buoys are placed to assist night navigation: A red light and bell buoy, marked "E," lying a little more than 1 mile south-southeastward of Roter Sand Lighthouse, shows an occulting white light, and marks the northeast side of the Roter Grund. It lies just eastward of the eastern limit of the sector of fixed white light directed up the Weser from the Roter Sand Lighthouse.

About 1½ miles southeastward of Roter Sand Lighthouse is moored a black conical buoy numbered 4, which shows a group flashing red light every 12 seconds—thus: flash 1.5 seconds, eclipse 2.5 seconds, flash 1.5 seconds, eclipse 6.5 seconds.

A black light and bell buoy, marked "9," lies in 8 fathoms of water, about ¾ mile west-northwestward of the western entrance to Dwars Gat, and shows a group flashing red light every 12 seconds.

A red light buoy, marked "N," showing a flashing white light in groups of 3 flashes every 14 seconds, is moored at the southern entrance to Dwars Gat.

The red buoy Q in the eastern part of the Dwars Gat exhibits an occulting white light every 10 seconds; light 7.5 seconds, eclipse 2.5 seconds. It is also a bell buoy.

The red buoys S and X in the Wurster Channel are light buoys, each showing a flashing white light.

Black light buoy No. 19 shows a group flashing red light every 12 seconds.

A red buoy, with white tower-shaped superstructure and red lantern, marked "Langlutjen N.," showing a fixed red light, is moored in 3½ fathoms off the north end of the Blexer Plate training wall, out of the main channel of the river.

The red buoy C in Bremerhaven Road, below the Kaiser Hafen, exhibits a group flashing white light, showing groups of 3 flashes every 8½ seconds.

A red buoy D, showing an occulting white light, is moored in 19 feet, off the edge of the Blexer Plate, on the west side of the channel, south end of Bremerhaven North Road.

A red buoy G with beacon-shaped superstructure lies opposite the entrance of the fishery harbor of Geestemunde and shows an occulting white light every 8 seconds, thus: light 5 seconds, eclipse 3 seconds.

On the appearance of ice the above light buoys are replaced by red spar buoys and black conical buoys, according to the side of the channel on which they lie. The winter buoys are numbered and lettered in the same manner as the buoys they replace.

Ice.—The ice drift has a powerful influence on the depth of water, especially on the shoals; according to circumstances, the ice drift can form a channel or entirely destroy it. Owing to the improvements in the river and the employment of an ice breaker, the river is now kept open throughout the entire winter, even beyond Bremen Bridge. Steamers, and with their assistance sailing vessels also, are generally able to reach Bremerhaven and Geestemunde during the whole winter, notwithstanding the ice drift.

Ice may be expected in the Weser between mid-November and the early part of March, depending entirely on the severity of the winter; some years there is very little or no ice.

Observations extending over a period of eight years show that, on an average, ice appeared during the winter months on 19 days at Brake and in the vicinity of Hohe Weg Lighthouse, on 20 days at Bremerhaven, and on 13 days at Bremen.

The following remarks may prove interesting as to what occurred in former days, during a period of about 70 years, or from 1823-1893.

There were 22 winters without standing ice at the great bridge, and there were 1,466 days in all in which the Weser at Bremen was beset with standing ice. On an average only every third year brought standing ice and an average duration of 22 days.

In the very severe winter, 1870–71, there was the long period of 65 days of standing ice, commencing on Christmas Day. The next three longest periods were 1837–38, with 57; 1847–48, with 55; and 1857–58, with 52 days.

The earliest standing ice at the bridge was on November 17, 1858, while the latest was March 28, 1845, which, with 78 days in all during the two periods, shows the largest aggregate for standing ice. The interval during which such a state of things occurred in the 70 years at Bremen thus embraces a period of 132 days, or more than one-third of a year.

Ice signals for the Weser are shown from the old church tower of Wangeroog, also from Roter Sand and Hohe Weg lighthouses.

Pilots.—There are no pilots for Weser River on board the Weser Light Vessel. Pilot schooners cruise in the following localities:

1. In sight of the Weser Light Vessel; if possible between it and the Key Buoys.

2. Off Langeoog, in the track of steamers bound for the Weser.
3. North of Nordeney, in from 11 to 14 fathoms of water.
4. Within a radius of 4 miles from Borkum Riff Light Vessel.

A schooner is stationed in the mouth of the Weser for the purpose of taking off the pilots. She will not carry the distinguishing flag, and only when a vessel is in distress and exhibits a distress signal is this vessel allowed to pilot.

The exchange between sea and river pilots takes place in the roadstead of Bremerhaven.

The vessels are fore-and-aft schooners, painted black, without a foretopmast, and fly the Bremen flag (which is red and white in horizontal stripes) at the mainmast head, and have a large black W in the sail.

By night a white light is carried at the masthead, a red light 8 feet below, and the usual side lights, and a single flare is made every 15 minutes.

When at anchor the same lights as above with the exception of the colored side lights.

The rates for pilotage vary according to the season, being highest in winter and lowest in summer.

Roter Sand Lighthouse is an iron tower, 93 feet high, painted in red and white bands, with black base, erected on Roter Sand in 23 feet of water.

The principal light is fixed flashing and group flashing, with white and red sectors, at an elevation of 78 feet above high water, and visible 14 miles.

Should electricity fail, an oil light, visible 10 miles, will be substituted.

A secondary light, white fixed, in the northeast balcony of the same tower, elevated 75 feet, is visible 14 miles. The sectors of these lights are subject to alterations to meet changes in the channels.

Fog signal.—During thick or foggy weather a fog bell is sounded by clockwork three times at short intervals.

Bremen Light Vessel lies in the fairway and within the junction of the two channels, 4 miles within Roter Sand Lighthouse, and in what is generally a position of safety.

The vessel is painted red with the word "Bremen" in white on her sides. She has three masts and carries a red ball at the foremast head.

A fixed white light is exhibited at an elevation of 39 feet above the sea, visible 10 miles. A riding light is shown. Signals with guns, bell, and flags are made when vessels are seen standing into danger.

If the vessel has driven from her station no light is shown, and by day a black flag is hoisted at the gaff.

Fog signal.—In thick or foggy weather a steam foghorn is sounded. A bell will be struck during the long intervals.

Tidal currents.—At Bremen Light Vessel the flood current, general direction 154°, runs from four and a quarter hours before till one and one-half hours after high water at Dover; its greatest velocity is from two to two and one-half hours before high water at Dover, at which time the mean velocity at springs is 2¼ knots, and at neaps 1¾ knots; the greatest velocity ever observed at this time was 3 knots.

The ebb current, general direction 326°, runs from one and one-half hours after till four and one-quarter hours before high water at Dover; its greatest velocity is from four to four and one-half hours after high water at Dover, at which time the mean velocity at springs is 2¾ knots, and at neaps 1½ knots; the greatest velocity ever observed at this time was 4 knots.

Hohe Weg Lighthouse, situated on the northeast side of Hohe Weg, on the west side of the channel, 10 miles within Roter Sand Lighthouse, is a brick octagonal tower, 118 feet in height with a black top, from which is exhibited, at an elevation of 90 feet above high water, a fixed light with white and red sectors visible 15 miles.

Fog signal.—In thick or foggy weather a bell is sounded.

Wind signals, showing the direction of the wind at Helgoland and Borkum islands, are shown as at Cuxhaven from a semaphore, southeastward of Hohe Weg Lighthouse.

Signals.—A telegraph station is established at the Roter Sand and Hohe Weg lighthouses. Both are connected with Lloyd's. Messages signaled by the International Code can be forwarded. Vessels showing their national flag and distinctive signals are telegraphed from the lighthouse to Bremerhaven and Bremen.

Ice signals.—When there is much drift ice in the Weser the signal flags P B G, of the International Code, are shown at the Roter Sand Lighthouse. Ice signals, as shown from Wangeroog old church tower, are also shown from Hohe Weg Lighthouse.

Storm signals are also shown from Roter Sand and Hohe Weg lighthouses when necessary.

Ever Sand Range Lights are situated on the Watt or Sand on the north side of Dwars Gat.

The rear light (Ober Ever Sand), fixed, with white and red sectors, is exhibited, at a height of 96 feet, from a square black iron tower 113 feet high, with four circular turrets and a black lantern.

The front light (Unter Ever Sand), group occulting white, with a fixed green sector, exhibited at a height of 51 feet, from a tower similar in shape to that of the rear light, but only 69 feet high, with a white lantern, is visible 12 miles; the tower is situated 148° 1,312 yards from the rear lighthouse.

Fog signal.—In thick or foggy weather a bell is struck at both lighthouses.

The Robben Plate has extended to the eastward between buoys R and S, and the western limit of the above-mentioned green sector is intended to indicate to vessels of heavy draft how far to the eastward of the Ever Sand Range line they should keep in order to avoid the shallow water caused by this extension.

Robben Plate Light, occulting, with white and green sectors, is exhibited, at a height of 27 feet, from a red pile structure erected on the eastern side of Robben Plate.

Fog signal.—In thick or foggy weather a bell is struck.

Both lighthouses are telegraph stations.

Meyers Legde (Ledge) Light, fixed white and red, and occulting and group flashing white, visible 13 miles, is exhibited, at a height of 61 feet, from a white cylindrical tower on a black foundation, lantern red, the whole 79 feet high, situated on the sand east of the Dwars Gat. (See Light List.)

Fog signal.—In thick or foggy weather a bell is struck.

The lighthouse is a signal and telegraph station.

The old Meyers Legde Lighthouse, nearly ½-mile, 177°, from the new lighthouse, remains as a daymark.

Solthorn Light, fixed white with red sector, and group flashing white, is exhibited, at a height of 61 feet, from a white tower with red lantern situated on the embankment at Solthoren.

Wremertief Light, fixed, with white and red sectors, is exhibited at a height of 42 feet, from a black and white horizontally striped beacon situated on the dyke at Wremertief.

Brinkamahof Light, fixed red sector, and fixed, flashing, and group flashing white, is exhibited, at a height of 66 feet, from a red and white tower 82 feet high, erected ½ mile 326° from Brinkamahof Fort No. 1.

Fog signal consists of a bell.

A fixed white light is exhibited, at a height of 14 feet, from an iron framework tower, northward of the above light.

Bremerhaven—Range lights.—The rear light, fixed white, visible 17 miles, is exhibited, at a height of 111 feet, from a square brick tower 131 feet high, situated on the north side of the entrance to Neuer Hafen.

The front light, occulting red, is exhibited, at a height of 41 feet, from a square white and red structure, with ball and red lantern, situated on the west side of the large lock entrance to Kaiser Hafen.

Kaiser Hafen Lights.—A fixed light, with white, red, and green sectors, is exhibited, at a height of 45 feet, from a red brick tower situated at the end of the point projecting between the entrances of the two locks leading into the Kaiser Hafen.

Fog signal.—In thick or foggy weather a bell is struck at the above tower.

A fixed light, with white and green sectors, is exhibited, at a height of 44 feet, from a black iron support on the south side of the entrance to the small Kaiser Lock.

A fixed light with white and red sectors, is exhibited, at the same height as the above, from the north entrance point of the large lock.

Neuer Hafen Lights.—A fixed red light is exhibited from the north molehead, and a fixed light, with white and green sectors, from the south molehead of the Neuer Hafen.

Range lights, upward.—The rear light is fixed white, and is shown, at an elevation of 111 feet above high water, from the square tower on the north side of the Neuer Hafen entrance. The front light is fixed red, and is shown at an elevation of 51 feet above high water from an iron conical tower 80 feet high, with red and white horizontal stripes, with red lantern and ball, situated on the south side of the entrance to Neuer Hafen, 185° 185 yards from the rear light.

Alter Hafen Light, group flashing white, is shown from a black buoy marked “Geeste Einfahrt” near the north mole at the entrance to Alter Hafen and the Geeste River. (See Light List.)

Fog signal.—A foghorn is sounded on the north mole at the entrance.

Geestemunde Lights.—A fixed green light is shown on the quay on the south side of the entrance to the Geeste, from a gray pyramidal iron staging with green lantern. The light is elevated 31 feet above high water and visible 7 miles.

Fog signal.—In case of necessity a bell inside the above staging is rung.

A fixed green light is shown from a post at the west end of the jetty on the south side of the river entrance.

Fischerei Hafen Lights.—A fixed red light, 36 feet above high water, is shown from a gray round tower with red lantern, situated at the end of the north mole at the entrance.

Fog signal.—In thick or foggy weather a bell is sounded.

Two fixed red lights are shown from the mole on the north side of the entrance, and two fixed green lights from the extremity of the mole on the south side of the entrance.

A fixed red light, elevated 94 feet above high water and visible 13 miles, is shown from a black pyramidal iron framework beacon, with square topmark, situated near the south end of the fishery harbor. The side of the topmark facing down river is painted black and red.

Beacons.—Ost Ever Sand Beacon stands near the edge of the sands on the northeast side of the Dwars Gat, about 670 yards southward of Ever Sand Front Lighthouse.

Between the Brinkamahof Forts are three black beacons on the steep edge of the sands; No. 1, the northern, has a cylindrical topmark; No. 2, a cube; and No. 3, a cone, point upward.

Telegraph beacons.—Two telegraph beacons stand on each side of the river, on the sands northward of Forts Brinkamahof No. 2 and Langlutjen No. 2. The front beacons have triangular and the rear beacons square topmarks.

Training walls or dams have been built for the purpose of controlling and directing the tidal currents in the river. One extends in a north-northwesterly direction from Blexen on the left bank for about 3½ miles along the Blexen Plate. Its north end is marked by a red light buoy, and its south end by a white beacon buoy with red topmark, maked "Langlutjen N." and "Langlutjen S.," respectively. On the right bank another extends from abreast Insum, for about 1,670 yards in the same direction as the first-named; others lie in the bend of the river at Meyers Legde, and between the Ost and West Ever Sands.

Anchorages.—There is good anchorage abreast Hohe Weg Light house is 6 to 8 fathoms.

Bremerhaven and Geestemunde Road is bounded on the north by a line drawn through Lehe Church and No. 3 beacon, and on the south by a line from Wulsdorf to Blexen Church. Inside these limits it is divided into the North and South roads.

The eastern limit of the anchorage is marked from northward by the lighthouse on the north mole of the entrance to the Fischerei Hafen in line with the road beacon, until the lighthouse on the south mole of Neuer Hafen is in line with the rear lighthouse near the lock there, which line is continued until G light buoy bears 213° 30′.

The best anchorage in the road is between the entrances to the Neuer and Alter hafens, but ships must not anchor abreast of these entrances.

Signals for obstruction in fairway.—When the fairway of the Weser is obstructed by sunken vessels or vessels aground, special signals are made by night at Roter Sand and Ever Sand Front lighthouses, Bremerhaven, Funfhausen, and Vegesack.

The stations at Roter Sand and Ever Sand Front lighthouses and Bremerhaven make signals for obstructions in the fairway of the river from the sea to Bremen. The stations at Funfhausen and Vegesack only refer to the river between Bremerhaven and Bremen.

The Weser is divided for this purpose into seven sections. For each of these sections a particular signal is provided. The sections of the river and signals for them are as follows:

1. The sea to Hohe Weg: A red and a white light, horizontal.
2. Hohe Weg to Meyers Legde: Two red lights, horizontal.
3. Meyers Legde to Bremerhaven: Two white lights, horizontal.

4. Bremerhaven to Brake: Three white lights, forming a triangle.

5. Brake to Huntemundung: Two white lights with a red light below them, forming a triangle.

6. Huntumundung to Vegesack: Three red lights, forming a triangle.

7. Vegesack to Bremen: Two red lights with a white light below them, forming a triangle.

By day the warning signal, regardless of the section of the river in which the obstruction is situated, consists of a green square flag.

River regulations.—Steamers moving their engines when lying at anchor in the Weser River below Bremen must carry a black ball of at least 2½ feet in diameter at the foremast. Vessels disregarding this regulation are liable to a fine.

Steamers, when near small or deeply laden vessels with low freeboard, or dredgers, etc., must reduce speed in time, so that no danger can arise from the swell caused by them; if necessary the engines must be stopped until the danger is past.

Ballast, ashes, stones, etc., must not be thrown overboard in the fairway, but only where it is permitted by the proper authority.

Vessels must carefully avoid causing any injury to the bank, shore establishments, works, and piers. Steamers must keep as far as possible from the banks and from the river structures and dredgers. In sharp bends of the fairway or near sunken vessels steamers must proceed at a moderate speed; also when near places marked as dangerous or under construction, as well as near such places where raising operations, diving, or blasting are taking place. By day all these places are marked by a red cylinder and at night by three lights placed vertically, the upper and lower ones being white and the middle one red.

Seagoing vessels which owing to their draft or length are obliged to keep in the deepest fairway must, provided they are in charge of an official pilot, hoist the following signal:

By day a red burgee (letter B of the International Code) at the foremast head.

By night a red light, visible all round the horizon at least 2 miles, placed vertically above a white light and not less than 6 feet from it; that is, on steamers, vertically above the white masthead light.

When being towed, only the vessel towed is to show these signals.

Vessels not in charge of an official pilot must not exhibit these signals.

Steamers intended for ice breaking or for laying out buoys in the Weser must, when so employed, always show the above-mentioned signals, even when they are not in charge of a pilot.

Between the mouth of the Lesum at Vegesack and Bremen a sailing vessel crossing must get out of the way of a steamer as soon as the latter gives the warning signal with the steam whistle—viz, a blast of not less than 10 seconds' duration. The steamer must at the same time reduce speed. This rule does not apply to tugs without a vessel in tow.

In order to call attention, when necessary, steamers underway may, on sighting another vessel, give a blast of the steam whistle or siren of not less than 10 seconds' duration.

Quarantine.—Bremerhaven is the quarantine station for vessels bound to Bremen. The quarantine ground is situated below the port, to the westward of the line of spar buoys, and is marked by a yellow can buoy.

Prohibited anchorage.—Vessels are forbidden to anchor in the neighborhood of the Roter Sand Lighthouse, in the space between a line joining spar buoy C and No. 3 black buoy and the prolongation of a line joining spar buoy D and Wangeroog Lighthouse. Anchorage is prohibited between the bearings of 303° 30′ and 135° of the Roter Sand Lighthouse within 550 yards of it; also near the line joining Roter Sand and Schillighorn lighthouses. Telegraph and electric light cables are laid in the above area. Anchorage is prohibited in Dwars Gat, southward of black buoys 11 to 14, and Meyers Legde Old Lighthouse, and northward of spar buoys O to R; also in the eastern half of the Wurster Channel Fairway from Fort Brinkamahof to Geestemunde; also abreast the haven entrances. Anchorage is prohibited on the lines of the various range lights.

Vessels must not anchor off the wharf at Blexen, between J and K spar buoys, in the space between the line of the Flagbalgersiel Leads, and the red road buoys inshore to the northward.

Two telegraph cables have been laid across the Weser from Weddewarden village to Lang Lutjen Sand. The route of these cables is marked by two green beacons on the foreshore and by three green spherical buoys, all marked "T."

Vessels are forbidden to anchor on the route of these cables or to drag their anchors over them.

Tides and tidal currents.—The high water interval at Roter Sand Lighthouse, at the entrance of the Weser is 11 h. 26 m., springs rise 11¼ feet; at Hohe Weg Lighthouse 0 h. 25 m., springs rise 12 feet; and at Bremerhaven 0 h. 32 m., springs rise 13 feet. The flood runs up for nearly six hours and the ebb down for six and one-half hours at Bremerhaven.

From a series of observations taken from Bremen Lightship, the greatest velocity of the flood current observed was 3 knots, and the ebb 4 knots; the mean velocity of the flood 1¼ knots and the ebb 1.7 knots.

The currents turn nearly at the times of low and high water at Cuxhaven, but do not always set fairly through the channels and sometimes set across. This fact must be borne in mind, especially in the Dwar Gat.

General directions for the Weser.—From the uncertainty of the light vessel or buoys in the river being in their proper positions, especially during the winter months, strangers should secure the services of a pilot before entering the river.

Steam vessels from the offing northwestward will usually sight Helgoland, and from thence shape course for the Weser Light Vessel; if from along shore, follow the directions given for sailing vessels.

In a sailing vessel from the westward, with westerly or southwesterly winds, the best plan to pursue is to make the Norderney Light Vessel passing northward of the bell buoy moored in 9 fathoms, 4 miles offshore abreast the west end of Norderney Island. The course should then be shaped for the Weser Light Vessel, which lies 94°, 31½ miles from the Norderney Light Vessel. When approaching and within sight of the Weser Light Vessel the position may be ascertained by bearings of it and Wangeroog old church tower or lighthouse, and the course altered to pass northward of the Schlüssel or Key Buoys. With northwesterly and northerly winds it will be better to sight Helgoland, and to steer such a course with respect to the tidal current as will keep it bearing about 0° until the Weser Light Vessel or Wangoroog Lighthouse has been sighted.

When approaching the mouth of the Weser from the northward, Wangeroog Lighthouse must not be brought to the westward of 196° to avoid the shoal water on Norder Gründe.

In hazy weather, while in the vicinity of the mouth of the Weser, no vessel should go into a less depth than 13 fathoms unless certain of the position of the vessel.

From the Schlüssel or Key Buoys, which lie 4 miles southeastward of Weser Light Vessel, the course is for Roter Sand Lighthouse, passing northward of the Aussen Jade Light Vessel and between the red buoys on the starboard hand and black buoys on the port hand, until within 1½ miles of it; thence over the bar southward of Roter Sand Lighthouse, keeping on its southern side toward light and bell buoy E to avoid the patches in mid-channel where there is a depth of 4 fathoms.

Thence a 143° course leads between the buoys, past the Bremen Light Vessel, but care should be taken not to approach the line of buoys between E light and bell buoy and F 1 spar buoy, as the Roter Gründe extends close out to the line of buoys. Having reached a position between L and No. 9 buoys, the course should be altered to 98° to enter the Dwars Gat, taking care to keep southward of the line joining Nos. 9 and 10 buoys, and attending to the tide, which here sets across the channel.

On the bar of the Dwars Gat, between Nos. 10 and 11 buoys, the deepest water will be found on the north side of the channel. Steer the above course between the buoys until the Ever Sand Front Lighthouse is in line with Ever Sand Beacon, when the course should be altered to 123° 30′, until the two Ever Sand Lighthouses are in line 328°, which kept astern on that bearing lead through the Wurster Channel, in which a depth of 3¼ fathoms at low water is reported abreast of No. 18 buoy, until Solthorn Lighthouse bears 84°.

A more southerly course must now be steered between the buoys until the range beacon at the Kaiser Hafen and the lighthouse at Neuer Hafen are in line 144°, which line must be followed until Fort Brinkamahof No. 1 is nearly abeam, when a 152° course will lead to Bremerhaven Road. Between Nos. 23 and 24 buoys, about 1 mile below Brinkamahof No. 2 and also between Nos. 1 and 2 beacons, patches of 18 and 19 feet extend into the center of the fairway; deep-draft vessels should, therefore, keep on the west side of the channel in this part.

A tide gauge, painted in red and white horizontal stripes, stands at the edge of Wurster Watt, near No. 19 buoy.

Bremen Light Vessel may also be approached from the northward through the Alte Weser, or old channel of the Weser, as it is marked by buoys; but though it is constantly used by coasters, it is not a passage to be recommended to a stranger. The northern approach to the channel through the Roter Sand is marked by two red buoys, close together, C 1 and C 2, on the starboard hand entering, and on the port hand by a black light and bell buoy, marked "A. W. 1," which exhibits an occulting white light every 10 seconds. This buoy is replaced by a black conical buoy, marked "1," on the appearance of ice.

A secondary passage through the Fedderwarder Channel and Wremer Loch, westward of the Robben Plate, branches off the main channel abreast of Hohe Weg Lighthouse, and reunites with it between red light buoy X and the red and black beacon buoy moored off the southeast end of the Robben Plate, where the depths are from 14 to 17 feet at low water. These channels are buoyed but not lighted.

At night the more prudent course will be to keep under way and maintain a proper position, which will be determined by bearings of the lights, until a pilot is obtained. Vessels from the eastward and northward will find the Weser Light Vessel a good point of departure for the entrance of the Weser River; those from the westward steer to enter the sector of fixed white light shown from the Roter Sand Lighthouse, which sector passes a short distance south of the Weser Light Vessel. Northward of the fixed sector the light shows double white flashes, and southward single white flashes at short intervals.

When within the fixed white sector, steer about 102° toward the light. While on this course a sector of fixed red light from Wangeroog Lighthouse will be passed through. When this red light changes to quadruple white flashing, bearing 230°, alter course to 116° and steer toward the occulting white light on bell buoy E, keeping it a little on the starboard bow. When past the light buoy, cross gradually into the sector of fixed white light from the Roter Sand Lighthouse and steer about 143° up the Weser, passing eastward of the Bremen Light Vessel, with a fixed white light, until abreast of No. 9 bell buoy with occulting white light, when Meyers Legde Light, which has been showing double white flashes, will change to fixed white, when alter course 95° toward it. The Roter Sand Light shows single white flashes to the westward of the fixed white sector from that lighthouse and double white flashes to the eastward.

The alteration toward Meyers Legde Light should be made when within the sector of fixed red light shown from Hohe Weg Lighthouse, between the bearings of 154° and 170°, the latter bearing passing close to No. 9 buoy. Steer toward Meyers Legde Light as above directed, keeping in the fixed white sector which leads through Dwars Gat. When on this course, Solthorn Light will be first seen white triple flashes on the starboard bow, and the Ever Sand Rear Light on the port hand will appear fixed red. When the latter changes to fixed white the Solthorn Light will also change to fixed white, and the course should then be altered to 122° toward Solthorn Light. The group flashing red light and bell buoy Q will here be passed on the starboard hand and must not be approached too closely. Keep in the fixed sector of Solthorn Light until the two white Ever Sand Lights (rear light fixed, front light occulting) come into line 328°, when alter course 148°, keeping them in line astern. At about the same time that the latter lights come into line, Meyers Legde Light will change from occulting white to fixed red.

Continue with the Ever Sand Lights in line, until Solthorn Light changes from red to fixed white, bearing 95°, when steer 156°, or more southerly in deep-draft vessels, until the Bremerhaven range lights (rear light fixed white, front light occulting red) are in line 144°, which line should be followed until above Fort Brinkamahof No. 2. These range lights will come into line when near the red light buoy Q, with occulting white light, which should be left on the starboard hand. About halfway between the latter buoy and Fort Brinkamahof a similar light vessel will be passed, also on the starboard hand.

Above Fort Brinkamahof No. 2 the fixed red light of the road beacon in line with the fixed red light on the head of the north mole of Geestemunde fishery harbor leads to the anchorage in Bremerhaven Road.

Outward, by night.—The above directions reversed will carry a vessel to below Wremen into the southern and fixed red sector of Solthorn Light. The course should then be altered to 336° until the northern red sector of Solthorn Light is sighted and the Ever Sand Range Lights are in line, 328°, when the latter should be steered for until the northern fixed white sector of Solthorn Light is reached, the approach to which will be indicated by the red sector of fixed light from Meyers Legde Lighthouse.

Steer 102° in the Solthorn fixed white sector, keeping the light right astern and taking care not to approach too closely to buoy Q, with group flashing red light, on the port hand, until the occulting white light of Meyers Legde changes to fixed and the eastern red sector of the Ever Sand Rear fixed light changes to white. The course is then 276° to abreast No. 9 light and bell buoy, keeping Meyers Legde fixed white light astern.

Pass through the eastern red and the white sectors of Hohe Weg Light, and as soon as the latter is again red, which will be when abreast No. 9 buoy, alter course for the Roter Sand Lighthouse, keeping in the sector of fixed white light; and as soon as the fixed red sector of light from Wangeroog Lighthouse appears, after passing the Bremen Light Vessel, alter course to 328°, crossing into the two-flash sector of Roter Sand Light and remaining in it until Wangeroog Light shows quadruple white flashes and the occulting light buoy E is passed, leaving it at least 100 yards to port; thence reverse the directions given for entering the river.

Bremerhaven, a free port, upon the right bank of the Weser, about 30 miles above the Weser entrance fairway buoys, is the proper port of Bremen, from which place it is distant 35 miles. It is the headquarters of the Norddeutscher Lloyd Co., and has magnificent harbor accommodation. The western quays of Kaiserhafen, and of Neuer Hafen as far as the gate, are used exclusively by the vessels of this company; the eastern quays are at the disposal of other vessels. Alter Hafen is used by the fishing and coasting trade.

There is railway and telegraph communication with the Continent, and both are connected with the wharves in the harbor. The telegraph offices at Bremerhaven and Geestemunde are open until midnight.

Mid-European time (one hour fast on Greenwich) is kept.

Sailors' home.—There is a sailors' home, with about 50 beds.

Hospitals.—There are two hospitals in the town.

Basins.—There are four basins or wet docks at Bremerhaven, the principal of which is Kaiserhafen. It is 4,758 feet in length, from 375 to 970 feet in breadth, giving an area of 47 acres, and it has a depth of 31 to 36 feet. The great lock is 732 feet in length by 91¾ feet in breadth, with a depth on sill of 34¼ feet at high water ordinary springs. The other lock has 25 feet.

The extensions of Kaiserhafen, known as Kaiserhafen Nos. 2 and 3, are 1,640 feet and 1,968 feet long, respectively. They are equipped with 27 electric cranes.

Docks.—(See Appendix.)

Repairs.—There are workshops of all kinds to repair ships and machinery. Vessels of any size can be built. There are electric cranes on either side of the dry dock capable of lifting 50 tons, and one in the southwest corner of the Kaiserhafen of 150 tons.

Coal.—A supply of steam coal is always available; about 30,000 tons are kept in stock here and at Geestemunde; the coaling wharves are about 39,000 feet long, with depths of 29 feet alongside. Liquid fuel can also be obtained.

Trade.—The principal imports are cotton, tobacco, wool, rice, cereals, and petroleum.

Storm signals—Pilots.—There is a storm-signal station night and day at Bremerhaven, which is also a pilot station, and there is a storm-signal station at Geestemunde.

Vessels requiring to enter Bremerhaven hoist a flag at the main, and lower it a little if a steam tug is wanted. If wanting to enter Geestemunde hoist two flags at the fore, one above the other.

Vessels requiring pilots for Brake, Nordenham, or any Oldenburgh port in the Weser district exhibit the following signals:

By day: Flag P at foremasthead and a blast of at least 10 seconds' duration with the steam whistle.

By night: A white light shown above the bow or a flare-up light, accompanied by a blast of at least 10 seconds' duration with the steam whistle.

If desired a pilot for Geestemunde the flags P T are hoisted at the foremasthead by day, accompanied by two blasts of at least 10 seconds' duration with the steam whistle.

At night two flare-up lights are exhibited, accompanied by two long blasts with the steam whistle.

Vessels wanting a pilot for Bremen or Vegesack give the following signals:

By day: Flags P T Q are hoisted at the foremasthead, and three blasts of at least 10 seconds' duration given with the steam whistle.

By night: Three flare-up lights, shown at short intervals, accompanied by three long blasts with the steam whistle.

Signals for obstructions in the river are made from a signal mast situated on the northern side of the entrance to the Neuer Hafen.

A radio station is situated on the south side of the entrance to Neuer Hafen; call letters K B H.

Lifeboats are stationed at Dorumer Siel, about 4 miles eastward of Meyers Legde Lighthouse; at Wremertief, about 6 miles below Bremerhaven; and at Fedderwarder Siel, 8 miles below Bremerhaven on the opposite side of the river. A lifeboat is stationed in the Geeste River above the swing bridge.

Time signal.—The signal at Bremerhaven is made from a station a little southwest of the lighthouse. A black ball drops at 0 h. 00 m. 00 s., or mean noon, mid-European mean time (fifteenth meridian), corresponding to 23 h. 00 m. 00 s., Greenwich mean time; also at 1 h. 00 m. 00 s., mid-European mean time, corresponding to noon, Greenwich mean time.

Ten minutes before the signal the ball is raised to about half its height, and three minutes before the signal to its full height, 128 feet above high water. Should the signal fail, a red ball is shown until the black ball is lowered.

Geestemunde—Basin and docks.—Geestemunde, a free port, adjoins Bremerhaven, being on the opposite side of Geeste River, which is only about 150 feet wide. It is an important fishing port and has also a considerable trade in petroleum.

Fischerei Hafen.—The fishing boat basin, which is tidal, is situated to the southward of the mouth of the Geeste. It is 1,400 yards long, about 90 yards wide, and has a depth of 14 feet at low water in the entrance, with 18 feet at high water alongside the quay on its western side. There is a large fish market and railway communication.

Wet docks.—The large wet dock, known as Geestemunder Hafen, is entered by a lock 239 feet long, 76½ feet wide, with a depth of 25 feet over the sill at high water. The depth in the dock is also 25 feet.

At the south end of Geestemunder Hafen is the Petroleum Dock, 256 yards long and 48 yards wide. On the quays are large reservoirs for petroleum. There are several hydraulic cranes.

At the northern end of Geestemunder Hafen are the Haupt and Quer canals, in which the depth is 19½ feet. At the head of the former is Holz Hafen, which is used as a timber pond.

There are three dry docks, two large and four small slips, and two patent slips. The two largest docks are each 541 feet long on blocks, 80 feet wide at entrance, with 17 feet on sill and 16 feet on blocks at high water springs. The third dock is a double dock. The largest slip is 550 by 81 feet. It and the next in size are provided with electric overhead traveling cranes.

There are also three building yards, where the largest iron vessels, either sailing or steam, can be built.

Communication.—Geestemunde has railroad communication. Ferryboats run to Nordenham and to Blexen, the terminus of the railroad on the left bank of the Weser.

Measured mile.—Two pairs of beacons, between Blexen and Flagbalgersiel, mark the distance of 1 sea mile, the line being Flagbalgersiel Light Beacons in transit.

Upper river—Bremerhaven to Bremen.—Pilots for the Oldenburg ports on the left bank of the river and also for Bremen can be obtained at Bremerhaven Road from pilot schooners. Vessels requiring a pilot for one of the Oldenburgh ports should hoist one flag; those requiring one for Bremen should hoist three flags, one above another at the fore.

Between Blexen and Bremen beacons are erected on both banks at every half kilometer (547 yards) from the latter place, the distance being about 34 miles.

The channel is buoyed nearly as far as Bremen. The marks are so placed that in ordinary conditions one can be seen from the position of the next.

The customs boundary lies above Blexen, at Einswarden, and is indicated by a post with board marked "Zollgrenze" on each bank. A watch vessel is moored here.

Anchorage—Buoyage.—Southward of Blexen there is sheltered anchorage in northwesterly winds, care being taken not to anchor near the line of the Flagbalgersiel Range Lights.

At 1.8 miles above Nordenham, at kilometer 55, a red and black beacon buoy marks the end of the sea and the commencement of the river system of buoyage.

Training walls or dams for the regulation of the current have been constructed in numerous places on both sides of the river. Some of these show during the last part of the ebb. They are marked by beacons.

Anchorage is prohibited between the village of Dedesdorf and the south end of Dedesdorfer Plate in the vicinity of the telegraph cables, the position of which is indicated by beacons on either bank, and also within 200 yards above and below the ferry steamer wharf at Dedesdorf and Kleinensiel, on the opposite bank. Dedesdorf Church is conspicuous.

Light buoys, showing occulting white lights, are moored off Brake and Funfhausen. Vessels should not anchor westward of the line of light buoys off Brake. The light buoys off Brake are removed during the winter months; that off Funfhausen is replaced by a red can buoy.

The entrance to the Hunte River and port of Elsfleth is indicated by a red and black beacon buoy moored northward of the end of the training wall on the east side of the entrance and also by an occulting red and white light at night.

At Vegesack the junction of the Lesum with the Weser is marked by a beacon showing an occulting red and white light at night.

From Vegesack to Bremen the river is confined by protective works and has a bottom width of 87 yards at Vegesack and 77 yards at Bremen, in which a depth is maintained sufficient for a draft of 18 feet.

At night the Weser between Geestemunde and Vegesack is navigated by means of twelve pairs of range lights, besides others. Between Vegesack and Bremen the channel is indicated by means of lights placed close to the edge of the banks.

Nordenham is situated on the left bank of the Weser, 4 miles above Bremerhaven. Here vessels can anchor in the stream in 6 fathoms at low water or lie alongside an iron-built quay 1,000 yards in length, alongside of which there is a depth of 23 to 33 feet, provided with railway lines and steam cranes, where steam vessels can be coaled. At the north end of this quay is the entrance to the fishery harbor, marked by a fixed green light on the north side and a fixed red and green light on the south; to the southward of it is a large petroleum establishment. Nordenham is in communication with all parts by steam vessels, railway, and the electric telegraph. There is a hospital. The tide rises 10 feet.

Brake, on the left bank of the Weser, is a free port, about 14 miles above Bremerhaven. Vessels of 24 feet draft can now proceed to Brake.

A quay, 525 yards in length, at Brake admits of vessels of 24 feet draft lying afloat at low water. Vessels can discharge direct into the railway cars. There are two grain elevators on the river quay. Vessels than can not get to Bremen usually stop here. There are two hospitals. The tide rises 9.8 feet.

The wet dock is 1,120 feet in length, 400 feet in breadth, with a depth of 19 feet on sill at high water, springs, and about the same within. It is entered from a canal 750 feet in length and 130 feet in width, but the width of the entrance gates is only 43 feet. The quays are furnished with railway lines, steam and electric cranes, and are lighted by electricity. Vessels up to 16½ feet draft can use this harbor.

There is a double dry dock 341 feet long, 45 feet wide at entrance, with 14 feet on the sill at high water, springs. It is entered from the wet dock. Repairs to iron and wooden ships can be undertaken.

Vessels are coaled at the quays in the dock.

Storm signals are shown.

Tidal signals are shown from a signal mast at Funfhausen, which is situated about ½ mile to the southward of Brake.

Signals for obstructions in the fairway are shown at Funfhausen from the signal mast for the tidal signals.

Elsfleth, about 6 miles above Brake, is situated on the left bank of the Hunte, about 1 mile above the junction of the latter with the Weser. A shipping and fishing trade is carried on, and there is a navigation school. There are nearly 1,000 yards of wharfage. The railway quay is 437 yards in length, and vessels can load alongside it direct from the cars. It is stated that vessels drawing 19 feet can reach Elsfleth at high water.

There is railway communication with Brake and Bremen. The Hunte River is connected with the Leda, near Leer, by a canal suitable for small vessels only.

Tide.—The high water interval is 3 h. 00 m.; tide rises 8¼ feet.

Vegesack is a town on the right bank of the Weser, 7 miles below Bremen, just northward of where the Lesum River joins the Weser.

The harbor is a small tidal basin 820 feet long, 230 feet broad, with an entrance 52 feet wide crossed by a drawbridge. The depth in the basin is about 14 feet at low water.

There is a large shipbuilding yard here. A new quay is being constructed along the river bank; it has at one end a 100-ton crane.

Storm signals are shown.

Signals for obstructions in the fairway are also shown.

Port of Bremen—Tidal basins.—Hafen No. I (Freihafen) is about 2,200 yards in length by 140 yards in width, and 66 yards wide in the entrance. It is furnished with large sheds and warehouses, workshops for executing repairs, and two floating docks. There are 2,360 yards of quay accommodation on the north side and 2,035 yards on the south side. It also possesses 83 traveling cranes, 61 of 1½ tons, 20 of 2½ tons, 1 of 4 tons, and 1 of 10 tons; also a floating crane of 40 tons lifting capacity. The depth of this basin is 18 feet at low water.

Hafen II has been excavated between Holz and Fabrik Hafen and Hafen I. It runs parallel to the river and is of the same length as Holz and Fabrik Hafen, and has depths of from 18 to 27 feet at low water. This basin is equipped with over 30 electrical cranes.

Holz and Fabrik Hafen, with its approach, is about 2,000 yards in length, and has depths of from 14 to 21 feet at low water. It is to be extended.

Sicherheitshaven, now called Hohentorshaven, on the left bank of the river, is used as a customs harbor. Vessels up to 16 feet draft can lie afloat. Hafens I (Freihaven) and II are outside the customs area.

Werft Hafen forms a continuation of Hafen II, and extends northwestward for about 1,250 yards from its entrance, its breadth varying from about 90 to 215 yards.

Weser yard—Depth.—On the northeast side of Werft Hafen, and 2½ miles below Bremen Bridge, is situated the shipbuilding yard of the Weser Co. Werft Hafen has sufficient depth to accommodate vessels of 26 feet draft at low water. It is stated that vessels of 24½ feet draft can ascend the Weser to the Weser yard.

A new harbor, consisting of five large basins varying from 370 to 1,200 yards in length, has been constructed at Oslebshausen, situated northwestward of Bremen, on the eastern side of the river, below the Weser yard.

Floating docks.—There are two floating docks, which can be used together or separately. The combined length is 330 feet and from 46 to 49 feet in breadth, with a depth on sill of 18 feet; lifting power, 3,300 tons. They are moored in Hafen No. I.

A floating dock 385 feet long, 83 feet wide, 31 feet deep, with 23 feet of water on the blocks and a lifting power of 10,000 tons, is moored in the entrance to Warft Hafen.

(See Appendix.)

City of Bremen, one of three Hanseatic cities (Hamburg, Bremen, and Lubeck) of north Germany, is upon the Weser, about 68 miles above its entrance and about half that distance above Bremerhaven. The river divides Bremen into two unequal portions—the larger, called the old town, on the right and the new town on the left bank. The communication is maintained by a bridge. Both sides of the river are lined with quays. The principal buildings are the cathedral, the church of St. Ausgarius, with a handsome steeple 325 feet high, and the old town hall. There are three hospitals and a sailors' home.

It is proposed to deepen the river between Bremen and Bremerhaven to 27 feet, so that vessels drawing 25 feet may ascend the river at any time.

Trade.—The principal manufactures are woolens, cotton, leather, tobacco, refined sugar, rape oil, paper, etc., with above 100 breweries and distilleries, and several soap-boiling works and sail lofts. There is also a considerable trade in building and fitting out vessels. Owing to the improvements in deepening the river the traffic between Bremen and European ports has greatly increased.

Bremen has railway communication with all parts of the Continent. It is the principal German port for the embarkation of emigrants for America, and next after Hamburg in commercial importance.

Coal.—A large stock of coal is always on hand.

The telegraph office is always open.

Time signal.—On the tower of the harbor office a black ball is dropped similar to that at Bremerhaven. Position of signal station, latitude 53° 5′ 11″ N., longitude 8° 47′ 9″ E.

Tide.—The tide rises 5 feet.

CHAPTER VI.

HELGOLAND (HELIGOLAND) ISLAND AND THE ELBE RIVER.

(See note at beginning of Chapter V.)

Helgoland (Heligoland), near the head of the bight which it names, is nearly equidistant (about 20 miles) from the mouths of the Weser, Jade, Elbe, and Eider rivers.

Aspect.—The island is 1,800 yards in length northwest and southeast and 600 yards broad at its southeast end, whence it narrows to the northwest point. It is a mass of red sandstone, presenting on all sides a perpendicular face seaward, 175 feet high on the west side, and its bold unmistakable character renders it an invaluable seamark. Helgoland has been extensively wasted by the sea and is surrounded by broad rocky ledges, which project from its northern part nearly 1¼ miles 325° 30′, 1½ miles eastward, 1.3 miles southward, and ½ mile westward. Some patches on the northeast side, on the Krid Brunnen, dry from 1 to 3 feet at low water springs. It is strongly fortified, much improved, and no doubt that the wasting caused by the sea has been stopped or greatly reduced.

Depths.—The depths in the North Channel, as the approach to North Haven, Helgoland, from the northwestward is named, decrease gradually from 13 fathoms at 2 miles northward of the island to 3½ fathoms at the anchorage.

South Channel, the approach to South Haven, has a least depth of 3¼ fathoms on the range mark, with depths of 4 to 6 fathoms within; thence a bar with 2 fathoms of water has to be crossed to reach South Haven, where the depths are 3¼ to 3¾ fathoms.

The best water over the flat which separates North and South havens is about 2½ fathoms at low water.

Pilots may be obtained through the signal station. The Jade pilots are acquainted with the havens at Helgoland.

Helgoland Light, flashing white, is exhibited, from a yellow brick lighthouse with brown bands, situated ¼ mile from the south extremity of Helgoland, at a height of 269 feet.

In case of accident to this light, a reserve flashing white light is exhibited 4 feet above the main light; both lights are visible 23 miles.

Inner Harbor lights.—A fixed light with white and red sectors is exhibited at 1,200 yards 127° from Helgoland Lighthouse, on the south pier. This light is to assist vessels in proceeding for anchorage in South Haven.

A fixed red light is exhibited, at a height of 24 feet, from a beacon at the head of the south pier, and a fixed green light, at the same height, and from a similar beacon, from the head of the north pier.

Fog signal.—The fog signal station is near Nathurn Point, the northwest extremity of the island, 1,200 yards from the lighthouse and 165 feet above high water. The signal consists of a siren, with an explosive rocket as a reserve.

Bull Beacon, a mast with stays, 46 feet high, with a triangular head, is one of the marks for the Steen (Hog Steen). It stands about 200 yards southward of the lighthouse.

Harbor.—A harbor, protected by breakwaters, has been constructed at the south extremity of Helgoland.

Landmark.—A wind motor, situated about 400 yards northward from the lighthouse, forms a good mark. Also the old lighthouse (unused) is a good mark; situated to the southward of Helgoland Lighthouse.

Signal, telegraph, and life-saving stations.—There is a signal station in connection with Lloyd's and a German semaphore station near the lighthouse, in connection with the Continent by two submarine cables. (See the positions and prohibited anchorage on the plan.) Vessels can communicate with the signal station by the International Code.

There is a lifeboat, a rocket apparatus, and a storm-signal station at the south end of the island.

Radio.—The signal station is fitted with a radio installation for communicating with Cuxhaven and passing vessels; call letters, K A H. This station is only open to fishing and coasting vessels.

A telegraph buoy is moored westward of Helgoland, with the lighthouse bearing 72°, distant 1.1 miles. For the distance of 600 yards north and south of a line joining the buoy and lighthouse anchoring is prohibited.

Ice signals.—Vessels passing Helgoland may obtain from the lighthouse, by signal, information as to the condition of ice in the district adjoining Helgoland.

Outer dangers—Buoyage.—From Sandinsel, 1 mile eastward of Helgoland, ledges extend northwestward, gradually increasing their distance from Helgoland to 1.8 miles abreast Nathurn Point, its north extremity, and terminating in a patch of 2½ fathoms 342°. distant 2.6 miles from the same extremity. These are named Krid

Brunnen, Selle Brunnen, Peck Brunnen, Hohe Brunnen, and Selle Brunnen Kante, the northwesternmost. Within and parallel to them are the Olde Hoven and Witt Klif Brunnen, forming the eastern side of approach to North Haven. These ledges are very shoal and patches on them dry from 1 to 3 feet in places.

These form a danger to vessels passing eastward of Helgoland in thick weather, for which reason buoys have been placed some distance off them to give vessels timely notice of approach, as follows:

A light buoy (Dune O 2) painted white, and surmounted by two triangles, points away from each other, is moored at the southeast extremity eastward of Sandinsel, in 5½ fathoms, with the east beacon bearing 282°, distant about 1,600 yards. It exhibits a group flashing white light, showing groups of 2 flashes every 12 seconds, thus: flash 1½ seconds, eclipse 2½ seconds, flash 1½ seconds, eclipse 6½ seconds.

A white beacon buoy, with an east topmark (two triangles, points away from one another), marked "Dune O 1," is moored in a depth of 6½ fathoms, with Sandinsel Middle (east) Beacon bearing 194°, distant 2 miles and 1,100 yards, and 1.3 miles northeastward of the northeast corner of the ledges.

A black and white checkered light and whistle buoy surmounted by two triangles, marked "Sellebrunnen," exhibiting an occulting white light every 8 seconds—thus: light 4 seconds, eclipse 4 seconds—is moored in latitude 54° 14′ 19″ N., longitude 7° 50′ 24″ E.

About 110 yards south of the above light and whistle buoy is moored a small white station buoy marked "Sellebrunnen."

The positions here given for the buoys are not to be depended on, as they are liable to drift.

Helgoland Bight—Loreley Bank lies in Helgoland Bight, eastward of Helgoland, and has upon its shoalest part 4½ fathoms, whence to the southward the water deepens abruptly to 15 fathoms, but on the north and northeastern side there is a depth of 5 to 7 fathoms for a distance of 1½ miles. The shoalest part lies 4 miles 84° from Helgoland Lighthouse. A sector of occulting white light from the north beacon on Sandinsel is shown over the Loreley Bank, between the bearings of 256° and 268°. The north beacon light in line with Helgoland (flashing) Light, bearing 262°, leads over the bank.

Buoys.—The south end of this bank is marked by a white beacon buoy, marked "Loreley Bank S.," and surmounted by two cones, points downward, and a reflector.

A white watch buoy is moored about 100 yards to the northward of the beacon buoy. These buoys are withdrawn in the autumn.

Outer anchorage.—For vessels of deep draft there is anchorage during westerly winds at 1 mile eastward of Sandinsel in 7 to 8 fathoms, fine sand, with Helgoland Lighthouse bearing about 252°, distant a good 2 miles. This anchorage has the advantage of being readily quitted in case of parting cables or other emergency.

Steingrund.—An area of foul ground, 1½ miles in length north and south, by about 1 mile in breadth, in which are a large number of stony patches with from 26 to 32 feet of water over them, is situated northeastward of Loreley Bank. From the center of the area Helgoland Lighthouse bears 241°, distant nearly 7 miles.

Helgoland Light Vessel, red hull, three masts, two black balls (vertical) at the mainmast head, and "Helgoland" on her sides, exhibits two fixed white lights (vertical) at the mainmast head.

The light vessel is moored off the north end of Steingrund, and when off her station exhibits a black flag at the mizzenmast.

Fog signal.—A foghorn and a submarine fog bell are sounded at the light vessel in foggy weather.

Buoy.—The southern end of Steingrund is marked by a white light and whistle buoy, marked "Steingrund S.," surmounted by two triangles, points downward, and exhibits a flashing red light every 7½ seconds. This buoy is withdrawn from December to February annually.

Sandinsel or Sandy Island, resting upon some extensive rocky ledges, lies nearly 1 mile east of the south point of Helgoland and shelters South Haven. Several groins, for the protection of the island against the attacks of the sea, have been run out in various directions to distances varying from about 400 to 1,000 yards. The extremities of most of them are marked by red buoys. From the island extend northward the ledges above described.

A sandy spit, dry at low water, projects 800 yards eastward from Sandinsel. The bank extending south of it is named Aa de Brunnen.

The extension of the bank southwestward, with depths of 1¼ to 2 fathoms, forms the eastern side of the south channel.

Rocket apparatus.—There is a rocket apparatus on the west side of Sandinsel.

Beacon lights.—Three iron pyramidal beacons, exhibiting lights, all visible 10 miles, used for leading to the anchorages in North and South havens, are situated on Sandinsel.

North Beacon, 25 feet high, painted red, and surmounted by a red cone, point upward, exhibits an occulting white light from a height of 36 feet.

East Beacon, 43 feet high, painted black, and surmounted by a black ball, exhibits a light with fixed and group occulting white sectors, from a height of 57 feet.

These above lights in line, 127°, lead through the North Channel to North Haven.

West Beacon, 40 feet high, painted red, and surmounted by a red cone, point downward, exhibits an occulting white light from a height of 37 feet. (See Light List.)

Anchorages.—A sandy ridge, with about 2½ fathoms in the best track over it at low water, connects Helgoland with Sandinsel and its ledges and divides the space between them into two portions, named North and South havens. From the limited extent of Helgoland and the small protection it affords in gales from the westward the havens are at best but imperfect anchorages, while gales from northwest by north blow directly through them. Of the two, however, South Haven is the more exposed and contracted in space.

North Haven has depths of 3 to 5 fathoms over a bottom of stones and rock, with depths of 10 to 6 fathoms in the approach from the northward, the fairway of which is close northward of Nathurn Buoy.

Dangers.—On the south side of the approach ledges extend 1.3 miles northwestward of Nathurn Point, consisting of Nathurn Brunnen, with Repulse Rock, 10 feet of water, beyond. On the northeastern side are the Selle Brunnen and other ledges before described.

Rocks.—A rock, with a depth of 2½ fathoms, is situated with Helgoland Lighthouse bearing 207°, distant 1,100 yards, and a rock of 3 fathoms, with the same lighthouse bearing 204°, distant 1,240 yards.

Wreck.—A wreck between North and South havens, on the line between Sandinsel North Beacon and the east point of Helgoland, is marked by a green light and bell buoy, exhibiting a revolving green light every 10 seconds.

Buoyage.—Nathurn Light Buoy, painted red, marked "Nathurn," exhibiting a flashing red light every 7½ seconds—thus, flash 2½ seconds, eclipse 5 seconds—is moored in 11 fathoms at 800 yards 325° 30′ of Repulse Rock, which has 10 feet of water on it.

A spar buoy, painted red, lettered "A," and surmounted by a ball, is moored northward of Nathurn Brunnen, with Helgoland Lighthouse bearing 151°, distant 1.4 miles.

A spar buoy, painted red, lettered "B," and surmounted by a cone, point downward, is moored eastward of Nathurn, the north point of the island, in 4½ fathoms, with Helgoland Lighthouse bearing 174°, distant 1,400 yards.

On the northern side of the approach is the Selle Brunnen Buoy, before described, and a conical buoy, painted black, and numbered 1, is moored westward of Witt Klif Brunnen, in 7 fathoms, with Helgoland Lighthouse bearing 171°, distant 1.3 miles.

A conical buoy, painted black, and numbered "2," is moored in 3½ fathoms, with Sandinsel North Beacon 126°, distant 1,550 yards.

Anchorage.—The anchorage marks, in 3½ fathoms, are the lighthouse 213° and the East or Middle Beacon on Sandinsel 117°. There is deeper water in 5 to 7 fathoms farther northward, but the less the water the better the shelter.

Directions.—Entering North Haven from the northwestward, steer in with Sandinsel East and North beacons in line bearing 127° (lights fixed white and occulting at night), which leads nearly 200 yards northward of Nathurn Buoy, and thence between red buoy A and black buoy No. 1, and into North Haven. When near letter B red buoy, steer to pass between it and No. 2 black buoy, anchoring as above directed. If coming from the northeastward, the Selle Bruhnen Whistle Buoy should be given a good berth on the port hand in rounding, thence steering for Nathurn Buoy until the beacons are in line, as before mentioned. No stranger should attempt to enter the haven at night.

South Haven has depths of 3¼ to 3¾ fathoms in a pool 800 yards in length by 300 yards in breadth, with from 2 to 2½ fathoms at low water in its approaches both north and south.

South Channel.—South Haven is entered from the southward by South Channel, which has 3¼ fathoms on the range leading in. The channel is about 200 yards wide between the shoals northeastward of the Steen, and the ledges extending southwestward of Sandinsel before mentioned.

Dangers—Buoyage.—The Steen, or Hog Stean, the principal outlying danger in South Channel, the approach to South Haven, lies nearly 1 mile southward of the south part of the island. This rock has only 3 feet at low water, with the old light tower and Bull Beacon in line 333°, the latter distant 2,150 yards.

A black and white checkered bell buoy, marked "Hog Stean," is moored on the west side of the approach to South Channel, at about ½ mile to the southwestward of Hog Stean.

Hog Stean Buoy, a black beacon buoy, marked "Hog Stean," and surmounted by a cone, point downward over a ball, is moored 400 yards southward of The Stean, in 8 fathoms.

A buoy, conical, painted black and numbered "1," is moored about 100 yards eastward of The Stean, in 4 fathoms.

A spar buoy, painted red, lettered "A," and surmounted by a ball, is moored in 4 fathoms, on the east side of entrance to South Haven, with West Beacon on Sandinsel 16°, distant 2,000 yards.

A red light buoy, marked "B," exhibiting a flashing red light every 7½ seconds—thus: flash, 2½ seconds, eclipse 5 seconds, is moored in 3½ fathoms on the east side of South Haven, with the West Beacon on Sandinsel 29° 866 yards.

A red buoy, marked "C" and surmounted by a triangle, apex upward, is moored 800 yards eastward of the light on the south pier.

Obstruction.—A steamer drawing 12½ feet, entering the South Channel, struck an obstruction eastward of black conical buoy No. 1.

Anchorage.—There is anchorage in 3½ fathoms with the lighthouse bearing 289° and Sandinsel East Beacon 41°.

Prohibited anchorages.—Anchorage is prohibited in the vicinity of a telegraph cable laid between Helgoland and Sandinsel, marked by four green buoys, moored in a line curving to the southward from the Marine Mole to the latter island.

Sandinsel North Beacon Light shows over the line of the telegraph cable to the main island. Vessels should not anchor with that light occulting in sight between the bearings of 62° and 80°.

Regulations.—Steamers entering South Haven, if of greater length than 197 feet, or of more than 10 feet draft, may claim right of passage against other vessels if they hoist the following signals on the foremast:

By day: A cylinder, at least 3 feet long and 2 feet in diameter.

By night: A fixed red light, visible 2 miles, at 6 feet above the navigational light.

If the vessel claiming right of passage is overtaking a vessel, four short notes are to be given with the whistle or siren.

Vessels laden with explosives must hoist flag B of the International Code and anchor at least 200 yards distant from any other vessel.

Directions.—If entering South Haven from the southward, steer in with Sandinsel East and West beacons in line bearing 20°. This mark leads a little eastward of Hog Stean Bell and Hog Stean Beacon buoys, thence between the black buoy No. 1 eastward of Steen Rock and red buoy A, with ball, and when Helgoland Light bears 309°, steer 345° westward of red light buoy B to the anchorage. The least depth in this channel is about 2¼ fathoms, but in the event of a swell the flood tide should have well made before attempting to enter. Coming from the southeastward, the old lighthouse just open westward of Bull Beacon, 333° leads to the Hog Stean Beacon buoy.

By night, if entering South Haven from the southward, steer in with Sandinsel West Beacon Light (occulting white) in line with East Beacon Light (fixed white) 20°. This mark leads eastward of Hog Stean Bell Buoy and Hog Stean Beacon Buoy, thence between black buoy No. 1, eastward of The Stean, and red spar buoy A with ball, paying attention to the set of the tide.

When the arc of fixed white light shown from the beacon on the head of the south pier of the new harbor is well in sight, or when Helgoland Light bears 309°, course can be altered to 345°, anchoring when the light bears 289°. Strangers should not enter at night.

Tides.—(See General Tide Tables for tides at Helgoland.)

The currents run at a velocity of 1 to 2 knots in the havens, flood southward and the ebb northward.

The town is at the southeast point of the island, partly upon the summit of the cliff and partly upon a low tongue at its base. It consists of about 400 houses, containing about 2,000 persons, and is much resorted to by visitors from Germany for the sea bathing.

On the southeast side of the island at the southern end of the town is a stone pier faced with timber, 360 feet in length, known as the Marine Mole, at the head of which there is a depth of 2½ feet at low water. There are two large movable steam cranes on this pier.

ELBE RIVER.

Owing to the present war conditions and the great number of changes in aids to navigation and the canceling of all ordinary harbor rules and regulations the information in regard to the Elbe River and ports reached by means of it is very much abbreviated in this volume, and what is stated is based on conditions existing prior to the beginning of the war.

General remarks.—The Elbe is one of the largest rivers in northern Europe, being about 780 miles in length. After its junction with the Eger River it becomes navigable. In its course, which is northerly, it receives the waters of many rivers and discharges itself into the North Sea at the head of Helgoland Bight, at about 15 miles eastward of the Weser. The intermediate space is filled with sand banks, extending 15 miles offshore, which are partly dry at low water.

Navigable depths to Cuxhaven, Kaiser Wilhelm Canal Entrance, and Hamburg.—The river, between the sea and Cuxhaven, can be navigated by a vessel of any draft at high water neaps and about 21 feet draft at low water springs.

Between Cuxhaven and the Kaiser Wilhelm Canal entrance the least depth is 4¼ fathoms at low water springs, in the channel between Oste Bank and Oste Reef.

Between the canal entrance and Hamburg the navigable depth is 29½ feet.

During the spring of the year, when easterly winds are prevalent, the water level is reduced at times some feet; westerly winds increase the depths.

Banks in entrance.—The outer banks on the south side of the entrance to the Elbe are the Scharhorn Reef, Neuwerker Watt, Klein Vogel Sand, and Steil Sand. A portion of the Scharhorn does not cover at high water; the others dry several feet at low water springs; all are steep-to.

On the north side of the entrance are the Grosser Vogel, Gelb, and Haken sands; opposite to and eastward of Cuxhaven are the Kratz and Medem sands. The Grosser Vogel dries in patches; the others over most of their extent at low water springs.

The Middle Ground lies nearly in mid-channel, about 4½ miles below Cuxhaven. It is 3 miles long and ½ mile broad within the 3-fathom limit, and the shoalest spot of 2 feet lies about 1 mile within the western end.

The main ship channel of the river passes northward and eastward of the Middle Ground, with not less than 5¾ fathoms in the fairway.

The passage on the south side, between it and the Steil Sand, is named the Kugelbaken Fairway, the depths in which are reported to have decreased. At the eastern end of this fairway is a bar on which the depth is less than 3½ fathoms, subject to change. Both sides of the Middle Ground are marked by buoys.

Landmarks.—The most important landmarks in the approach to the Elbe are the beacons, the lighthouse on Neuwerk Island, the hospice at Duhnen, and the water tower, lighthouse, and garrison church at Cuxhaven.

Caution.—During the prevalence of ice reliance can not be placed on the light vessels or on the buoys maintaining their stations.

When the Elbe light vessels put to sea on account of the ice they resume their stations as soon as practicable.

The channels are buoyed in accordance with the German uniform summer and winter system, but strangers should take a pilot.

Ice.—In the Elbe, on the average, ice appears in December, and at irregular periods may interrupt navigation in the river until the end of February. At times ice appears in mid-November and as late as early March. The ice drift produces no change in the depth of the water, but the sands on both sides of the channel are changed frequently.

Pilots.—Pilot schooners cruise to the seaward of the mouth of the Elbe and steam pilot vessels inside the mouth. The pilot schooners are painted white and have "Elbe" in black letters upon the sail, and also carry a broad pennant and the Hamburg flag at the main; they have no foretop mast. At night they carry a white masthead light, show no side lights, and exhibit three flares in quick succession every 15 minutes. The steam pilots carry the same day signals as the schooners when pilots are aboard, and at night a red light 8 feet below a white light.

Pilotage in the Elbe is compulsory for merchant vessels of 135 tons register and over between the sea and the entrance of the Kaiser

Wilhelm Canal; above the position, vessels of deep draft and strangers should always employ a river pilot.

Tugs.—Tugs for towage are available, the signal for which is the national flag hoisted half-mast at the main.

Signal and life-saving stations.—Neuwerk and Cuxhaven are telegraph stations. Vessels communicate by the International Code. The signal stations at both entrances to Kaiser Wilhelm Canal are connected with Lloyd's.

Storm signals are shown at Neuwerk Island, Cuxhaven, the customhouse on the Oste, 1 mile below Neuhaus, Oste Reef Light Vessel, entrance to the Kaiser Wilhelm Canal, Gluckstadt, Brunshausen, Altona, and Hamburg.

Lifeboats are kept at Neuwerk, Duhnen, Cuxhaven, Neufeld, and aboard the Elbe light vessels.

Elbe light vessels.—There are five light vessels at the mouth of the Elbe. All the light vessels are painted red, and Nos. I, II, III, and IV are equipped with Morse apparatus for night signaling.

Oste Riff Light Vessel is moored off the entrance to the Oste River.

Fog signals are sounded, and No. I Light Vessel is fitted with radio apparatus. (See Light List for characteristics of vessels and their lights.)

Lighthouses and beacons along the Elbe and Oste rivers exhibit navigational lights, all of which will be found in the Light List.

The names of the lights are as follows: Neuwerk, Duhnen, Cuxhaven, Osterende Groden, Neufeld, Altenbruch Belum, Balje, Oste River, Sosmenhusen, Brunsbuttelkoog, and Brunsbuttel at Kaiser Wilhelm Canal entrance.

Many unlighted beacons are established on the Elbe, one at Scharhorn, on the sand bank on the south side of the entrance. It is 92 feet high.

Others are known as North, East, Kugel, Groden, and Rothe beacons.

Buoyage is of the German uniform system. Starboard-hand red spar buoys are marked with letters and port-hand black conical buoys are numbered. A light buoy exhibiting an occulting white light is moored about 200 yards southward of the southeastern end of the middle ground.

Tides.—At the entrance to the Elbe springs rise 9¼ feet. (See General Tide Table for tides farther up the river.)

Tidal currents.—Under ordinary circumstances of weather the flood current reaches as far as Hamburg, but when there is much water in the river it is not felt beyond Schulau or Blankenese.

H. O. Charts Nos. 5213 to 5224, inclusive, give the general directions of currents in the North Sea between latitudes 51° and 57° from five hours before high water at Dover till six hours after high water at Dover.

Under ordinary circumstances of weather the flood current reaches as far as Hamburg, but when there is much water in the river it is not felt beyond Schulau or Blankenese.

The direction of the tidal currents about the entrance of the river is considerably influenced by strong winds, and is slack hardly anywhere, but merely changes its direction, and that often, to every point of the compass. At Cuxhaven the flood makes at one and one-half hours after low water and attains a velocity of 2 knots; the ebb makes at one and a quarter hours after high water and attains a velocity of 3 to 4 knots.

At the Schulau Buoy, up river, the ebb runs from about three and one-half hours after high water at Cuxhaven until about two hours before the next high water there, with a maximum velocity of 2¾ knots and an average velocity of 1½ knots.

Cuxhaven Road.—The best anchorage is to the northeastward of the lighthouse, in from 6 to 7 fathoms, mud. Small vessels can anchor nearer the shore, between the Alte Liebe and Kugel Beacon, but not approaching too near the bank, which here extends a considerable distance from the shore. Sailing vessels leaving the river wait for favorable winds here.

There is an area of some extent surrounding a position situated in Cuxhaven Road, at a distance of 400 yards 16° from Cuxhaven Light, where many anchors have been lost. Mariners are, therefore, warned against anchoring in this area, as it may be difficult, if not impossible, to weight the anchor, in consequence of its being entangled with those already on the bottom.

A note, "Foul anchorage," has been placed on the plan of Cuxhaven Road in the above position.

The fairway of the Elbe abreast of Cuxhaven must be left clear.

Anchorage is prohibited.

Within the space bounded by conical buoys Nos. 13, 14, and 15 to the eastward, and the alignment of Osterende Groden Lighthouse and Rothe Beacon (red) to the westward.

By night within the space covered by the single flashing sector of Neufeld Light.

Pilot and lifeboat.—Cuxhaven is a pilot and lifeboat station.

Quarantine.—Cuxhaven is the quarantine station for vessels bound up the Elbe. The quarantine anchorage is off Groden, 1 mile to the southeastward, where there is a shore station, with a landing pier, at the end of which two white lantern lights are shown at night. The lights are unreliable.

Amerika Harbor is 1,066 feet in length by 820 feet in breadth, with a depth of 26 feet at low water springs, and has 1,430 yards of quay accommodation; the entrance, with same depth, is 328 feet wide between the piers, 400 feet in length, built parallel to the shore, with deep water berths on the river side of them. A green light showing white toward the land is exhibited on the north side of entrance, and a red light on the southern.

Two arms, or basins, extend inland from the upper part of the harbor, 900 feet in length by 260 feet in breadth, considerably increasing the wharfage, etc., accommodations; only the northern of these arms is finished.

The old tidal harbor, the northernmost, with an entrance 213 feet in breadth, will accommodate from 70 to 80 small craft, aground on the soft mud. The depth is but 6 feet at low water springs; craft of about 15 feet draft use it. Vessels loaded with petroleum discharge in the outer part of the harbor, and those with explosives have to discharge them before entering.

Vessels lying here are not permitted to use their screws from two hours before until two hours after low water.

Alte Liebe.—There is a depth of 16 feet alongside the river wharf, known as the Alte Liebe, forming the north side of entrance to the old harbor; it is used chiefly by passenger steamers. There is a fixed red and white light on the south extremity of this wharf.

The Fishing Harbor, between the old and Amerika harbors, has an entrance 164 feet wide, and a low-water depth of 10 feet. Vessels other than fishing craft are allowed to use it, but fishing craft are not permitted to enter the other harbors. There is a fixed green and white light on the north side of the entrance, and a fixed red light on the south side.

Signals to prohibit entry.—When entry to Amerika Harbor is prohibited, two arms on the signal staff on the southern pierhead are raised to a horizontal position, one arm pointing across the harbor entrance and the other arm, at right angles to it, pointing across the river.

By night, under similar circumstances, a green light is shown over a white light from the same signal mast.

The closing of the entrance to the old harbor is indicated in a similar manner from a signal staff on Alte Liebe.

Similar signals, displayed from a signal mast on a dolphin on the south side of the entrance to the fishing harbor, denote that that harbor is closed.

While the above signals are shown, the entrances may only be used by special permission of the harbor authorities.

The town of Cuxhaven is situated on the south point of the entrance to the Elbe.

It has attained considerable importance through its rail communication with Hamburg and the localities of the Lower Weser, and its new deep-water harbor, which is available at all times of tide, is extensively used by vessels whose draft does not permit of their going up to Hamburg. A considerable fishing trade has been developed, and the old harbor is much used by local craft and other vessels as a port of call and by vessels in distress. There is a large fish market. Population is about 6,898, consisting largely of traders, laborers, pilots, etc.

It is a free port with no harbor dues. The United States is represented by a consular agent.

Communication.—There is, at normal times, communication by steamer with Hamburg, and in summer with Helgoland and several times a week with the Frisian Islands, Norderney, and Fohr along the coast to the westward and northward, respectively. There is regular communication with London, Havre, Rotterdam, etc. A submarine telegraph cable is laid between Cuxhaven and Arendal in Norway. The telegraph office is always open.

Coal—Repairs—Supplies.—There is always coal in store, about 1,000 tons being kept in stock. Vessels can coal in either harbor or in the road. There are no dry docks at present, but the slips in the old harbor are suitable for vessels of about 300 tons. There are no manufactories or foundries yet, but small repairs can be done at the smithies, and repairs to machinery can be effected from Hamburg or Harburg. Fresh provisions can be obtained; bread is expensive; good water can be had at the wharf.

Port regulations.—The port regulations for Cuxhaven are same as those in force for the port of Hamburg.

Vessels bound up the Elbe to Hamburg are supplied at Cuxhaven with the customs signal, viz, a square flag, black and white diagonal, shown at the peak or on the ensign staff by day and a white light over a green light shown from the same position by night.

If the ensign be hoisted, the customs flag should be shown below it.

These signals are also required by vessels bound through the Kaiser Wilhelm Canal and may be hired from the canal authorities there.

Wind signals.—On the dyke, near the Alte Liebe, is an iron mast with a yard, at both arms of which is a vertical circle. The circles are divided into points, with a finger to indicate the direction of the wind. The eastern circle is marked with an "H" for Helgoland and the western circle with a "B" for Borkum. The north is above and the south below, the other points corresponding to their actual relative position. The force of the wind is shown by six arms at the top of the mast on both sides. When extended toward east the force of the wind at Helgoland is indicated and when to the west the force at Borkum. Each arm expresses an even number; that is, if one arm is raised, the force is two; if two arms, the force is four; and if three arms, the force is six; if the force is an uneven number, the next higher even number is always shown.

When from any cause the signal can not be made from either of the two places the upper arm on that side will be raised to an angle of 45° above the horizontal; the other arms and the pointer will hang vertically.

Telegraph.—Here is also the telegraph signal station, with night signal apparatus, in connection with Lloyds.

A radio station is established at Cuxhaven; call letters K C X, with a normal wave length of 600 meters.

Storm warning signals are shown from the wind signal station. At night a red light is shown.

Ice signals.—The ice conditions of the German North Sea coast and of the western approach to the Kaiser Wilhelm Canal can be obtained on demand from the signal station.

As instances of the ice conditions in the Kaiser Wilhelm Canal, the state of the ice in three winters which were severe, moderate, and open and mild, respectively, may be mentioned. In the winter of 1908–9, which was severe, ice breakers were employed on 17 days; in 1909–10, a moderate winter, the canal was closed for sailing vessels on three days; and in 1910–11, a mild winter, the canal was altogether open for sailing vessels.

Time signal.—The time signal is shown near the lighthouse, at a height of 78 feet above high water and 72 feet above the ground. A ball falls at 0 h. 00 m. 00 s., mid-European mean time (fifteenth meridian), corresponding to 23 h. 00 m. 00 s., Greenwich mean time; also at 1 h. 00 m. 00 s., mid-European mean time, corresponding to noon, Greenwich mean time. The ball is hoisted halfway up 10 minutes before signal and close up 3 minutes before signal. Should the signal fail, a red ball is shown until the black ball is lowered.

Tides.—See General Tide Tables.

Oste River.—Between Cuxhaven and Brunsbüttel and at 10 miles from the former the Oste River runs into the Elbe on the south bank.

There is a depth of 5 feet on the bar and within are depths of from 8 to 9 feet at low water.

The entrance to the river is marked by buoys for a short distance and above this by beacons and stakes.

Two light beacons in line lead into the river entrance.

Three dykes are under construction on the southwest side of the channel from abreast No. 3 black buoy up to 300 yards from the outer light beacon. The end of each dyke is marked by a red can or spar buoy.

On the west bank of the river, 2½ miles from the outer buoy, stands the customhouse, a two-storied building.

Neuhaus, situated 1 mile above the customhouse, exports cement, building stone, and tiles.

Storm signals, both day and night, are shown near the customhouse in the Oste River.

Brunsbüttel is a small port about ½ mile to the westward of the entrance to the Kaiser Wilhelm Canal.

The harbor can be entered at high water by vessels drawing up to 13 feet of water, but the accommodation is very limited.

A regular service of steamers connects the port with Hamburg in summer.

Brunsbüttelkoog is the name given to the settlement and works at the entrance to the Kaiser Wilhelm Canal.

Signal station.—There is a Lloyds signal station on the eastern side of the entrance to the canal.

Radio telegraph.—There is a radio station at the east side of the lock at Brunsbüttelkoog; call letters K B R.

Storm signals are shown from a mast on the western side of the entrance to Kaiser Wilhelm Canal.

Brunsbüttel Road.—The limits of the road are defined as follows:

To the westward by two masts on the left bank of the Braake River, eastward of Brunsbüttel.

To the eastward by two masts near the cement works on the eastern side of the Kaiser Wilhelm Canal entrance in line with the chimney of the works. The outer mast is on the eastern end of the loading pier.

To the southward by three light buoys A, B, and C. A and B have red and white vertical stripes and show occulting white lights, and C is black with an occulting red light.

During the winter, when the light buoys are removed, fixed white lights are shown from the masts. The southern limit of the road is then indicated by the church tower of St. Margarethan in line with a beacon, 60 feet high, with a square as topmark, situated about 2.8 miles eastward of the canal entrance, bearing 82°.

Vessels bound up or down the river must not pass within the above-mentioned limits, but southward of the light buoys.

Vessels bounds to or from the canal may anchor in the road eastward of a line joining the eastern side of the canal entrance and the middle light buoy (B), and through this anchorage no vessel is permitted to pass. Westward of this line anchorage is prohibited, as this is the fairway reserved exclusively for vessels entering or leaving the canal.

Vessels intending to enter the canal must wait for a pilot outside the roadstead limits.

Tides.—See General Tide Tables.

General directions—Approaching the Elbe.—For steamers or sailing vessels with fair wind, in fine weather, there is no difficulty in making the entrance to the Elbe, the dangers in the approach being well marked by distinguishing buoys and by the Elbe Outer Light Vessel. Helgoland is a good landfall from the northwestward, and coasting along from Borkum Light Vessel within sight of the Frisian Islands if coming from the westward. The Norderney Light Vessel should be made, after which the Weser Light Vessel will probably be sighted from that direction, and then the Elbe Outer Light Vessel.

A pilot is obtainable from the pilot boats cruising off the entrance or at Elbe III Light Vessel.

In thick weather a vessel should not stand into less than 12 fathoms without having obtained a pilot or identified some of the buoys or the outer light vessel. If also calm the vessel might anchor, and in bad weather stand off and on. The nature of the bottom near the outer light vessel is not distinctive enough to give the position, being mostly clay intermixed with sand, mud, and shells. Coming from the northwestward, the vessel will probably have obtained a departure from Helgoland, in which case, the run being short, she would not fail to make the outer light vessel.

If coming from the westward, after having sounded upon or identified Borkum Flat by the light vessel, steer easterly along shore in not less than 12 fathoms at low water, when the Norderney, Weser, and Elbe Outer light vessels will probably be made out by their fog signals. In this track the depths will be found to decrease from 17 to 12 fathoms over bluish clay to near the Elbe Outer Light Vessel.

In every direction seaward of the mouth of the Elbe there is good anchoring ground, and many a sailing vessel but scantily provided has, by anchoring and cutting away the masts, ridden out a heavy northwest gale when others running for the Elbe have been lost.

Vessels getting on the Grosser Vogelsand in west or northwest winds are usually lost with their crews, whereas if stranded on the Scharhorn the men have a chance of reaching the rescue beacon.

The best time of tide for entering the Elbe is about one-third flood, when the current runs directly in, but in heavy westerly winds the time of one hour before high water is to be preferred, for then, on account of the rise of tide, vessels of ordinary draft may, if they happen to diverge from the proper track, pass over several of the shoals without touching, and should they eventually touch the ground they are not long exposed to a heavy surging sea, and there is consequently less risk to life and property.

A gale from northwestward opposed by the ebb current causes the most dangerous sea at the mouth of the Elbe, and heavy riding abreast Cuxhaven, but vessels can now enter Amerika Harbor there at all times of tide.

Directions from sea to Brunsbüttel Road—By day.—From the Elbe Outer Light Vessel, or in her absence from a position midway between the Gross Vogelsand and Elbe buoys, shape course as requisite to pass Elbe Nos. II, III, and IV light vessels fairly close-to on either side; then across the bar, which has a depth of about 32 feet in the dredged channel at low water, direct for No. V Light Vessel, passing southward of her; from thence the course follows the alignment of Altenbruch Church, which has two slender towers, with Groden Beacon 151°.

From abreast of Cuxhaven the middle of the buoyed channel should be followed, passing southward of Oste Bank if in a vessel of heavy draft, and thence for the anchorage.

As the depth in the channel southward of Oste Bank is liable to change, especially in winter, it is not advisable for vessels of heavy draft to proceed through this channel at or near the time of low water.

After passing Neufeld Lighthouse, Ritzebuttel Schloss in line with Groden Beacon 282°, lead close southward of the bank extending from the Medem Sand.

By night, the light vessels are steered for as in the daytime. From No. V Light Vessel keep in the flashing sector of Neufeld Light, with this light in line with Osterende Groden Light 152°, until past Cuxhaven, when keep in the group flashing (5 flashes) white sector shown from Cuxhaven Main Light, until in the double-flashing sector shown from Neufeld Light. Steer then 114° into the occulting white sector of Altenbruch Light and keep this light in line astern with Osterende Groden Light 263°. When about abreast of Otterdorf the fixed white sector of Balje Light will be sighted right ahead; steer direct for it, which will lead southward of Oste Bank and of Oste Riff Light Vessel with fixed white light.

Belum Light will just be sighted on the starboard bow as a fixed white light, which changes to green when about abeam of it, when past Oste Mouth to group flashing white, and to fixed white when near Oste Riff Light Vessel. Keep in this fixed white sector, which leads up toward Sösmenhusen Light, and when in the fixed white sector of Balje Light, Scheelenkuhlen Light or the anchorage can be steered for.

The channel north of Oste Bank is buoyed. The least depth as charted is 2½ fathoms.

A sharp lookout must be kept, as there is much traffic on the river.

Rule of the road.—Steamers and sailing vessels in tow, proceeding up the Elbe, must keep the southern side of the fairway when passing Cuxhaven. If proceeding seaward they must keep the northern side when passing Cuxhaven.

Such vessels wishing to land a pilot or other person, or to communicate with the shore, should hoist a flag half-mast at the foremast by day or show a flare-up light at the bow by night.

In reply to the signal a small steamer from Cuxhaven will come alongside to take a pilot or receive the message for the shore at a fixed tariff.

Kaiser Wilhelm Canal—General remarks.—This canal, connecting the North Sea and Baltic, forms an alternative waterway for vessels of all classes trading to or from the Baltic. By it the passage from various parts of the North Sea is shortened in a more or less degree, according to their positions, while the necessity of passing the intricacies of the Belts in unfavorable weather is avoided.

The North Sea end of the canal enters the Elbe at Brunsbüttelkoog, 15 miles above Cuxhaven; thence the canal traverses Schleswig-Holstein and enters Kiel Bay, in the Baltic, at Holtenau, about 4 miles northward of Kiel.

The depths in the river below and in the approach from seaward are not less than 4¼ fathoms at low water springs.

Masters of vessels making use of the canal must obtain a copy of the general regulations and are bound to carefully follow the instructions in every particular. A copy will be supplied to each master on request, and constitutes the only authority for the obligations entered into between the canal authorities and the master or his employers.

Foreign vessels of war and royal yachts can only enter the canal after permission has been obtained through a diplomatic channel.

This canal has a depth sufficient for the deepest draft vessels.

The length of the canal is 53 miles.

At both ends of the canal there are two locks—one for entry and the other for exit.

Entrance may be effected at any time.

In case of large vessels timely notice must be given to the canal office at that end where the vessel intends to enter, so that the necessary arrangements may be made for passing other vessels.

Water level—Bridges.—The greatest range of water level at the Elbe end is about 10 feet, due to the tide, and involves the use of the locks for about 6 hours out of every 12.

At the Baltic end, at Holtenau, the greatest range, due to wind, is 1.7 feet, but variations of importance in the level occur only on about 25 days in the year, so that the locks at that end are nearly always open.

Four railroads cross the canal—two by means of swingbridges with equal arms, having a clear breadth of 118 feet. These are also available for the road traffic.

The West Holstein Railroad is carried by a fixed high-level bridge, near Grünenthal, which is also a road-traffic bridge, 138 feet above mean water level of the canal. A similar bridge and of the same height carries the Eastern Railroad at Levensau.

There are two other swing bridges for road traffic, respectively, at Rendsburg and near Holtenau.

New works.—It is probable that the following previously expressed intention to enlarge and improve the canal has been carried out: To increase the size of the locks, to widen the passing stations, and to straighten the curves in the canal.

The locks at both ends of the canal to be 1,082 feet in length, 148 feet in width, with a depth of water of 39 feet at low water, and 45 feet when the water is at its average height (equivalent to the mean height of the waters of the Baltic). The depth of water in the canal to be increased to 36 feet below the mean level, the width at the bottom to be 144 feet, and at the surface of the water 334 feet. The number of passing places or sidings to be increased to eleven, and there is to be four places where long vessels will be able to turn completely around. The two low-level swing bridges are to be replaced by high-level bridges.

Pilots—Towage.—Steamers may use their own engines in navigating the canal, but at the discretion of the authorities in exceptional cases. Towage is compulsory for sailing vessels if intending to pass right through the canal, whatever their size.

Pilotage is compulsory for all vessels, except those which are exempt from compulsory towage. Compulsory pilotage begins, for vessels coming from the Elbe, outside the roadstead of Brunsbüttel; for vessels coming from the Baltic between the lighthouse near Friedrichsort and the canal entrance; and for vessels coming from Kiel, in the road off Holtenau. Pilots generally board vessels when in these positions.

A change of pilots takes place at Nübbel, about 36 miles from the western entrance of the canal.

The day signal for a pilot is the national pilot flag, with the answering pennant of the International Code under it, at the foremast head.

By night: Two white lantern lights, horizontally, at least 3 feet apart, at the bows. The pilot station at Brunsbüttelkoog answers by three vertical white lights, which are hauled down as soon as the pilot embarks.

A steamer may use her steam whistle or siren for the purpose of summoning a canal pilot. The sounds to be used are: One long sound, three short, followed by one long sound.

If from any cause no pilot can be sent on board, the pilot stations will signal, by day, the International Code pennant D under the imperial flag; by night, three red lights, vertical. Pilots are responsible for their actions to the canal authorities.

General remarks.—Tugs are available at both ends of the canal, but pilots prefer to use the ship's engines.

The pilots bring their own helmsmen.

An anchor has to be kept ready over the stern, and vessels use their own hawsers and capstans in the locks.

Vessels enter the canal from the Elbe at high water, slack tide; otherwise it is difficult to steer in on account of the tidal current running across the entrance.

Canal lights.—A fixed red and white light marks the west side of entrance to the canal from the Elbe, and a fixed green and white light the east side of entrance. The banks of the canal are lighted by electricity. The outer entrance to the southern lock is indicated by white and red lights on the east and west sides, respectively, and similar lights mark the west and east sides, respectively, of the inner entrance to the northern lock.

There are several buoys in the canal to assist the pilots in night navigation.

Brunsbüttel Road to Hamburg.—**Scheelenkuhlen Light** is exhibited from a cylindrical brown tower erected on the dyke at Scheelenkuhlen, about 5 miles to the eastward of the entrance to the Kaiser Wilhelm Canal.

After passing Scheelenkuhlen the river bends to the southeastward and becomes encumbered with banks, which are constantly changing, rendering the navigation difficult.

Above this the channel to Hamburg is marked by numerous buoys on the uniform system, also by many pairs of range lights.

Light buoys.—On the north side of the fairway, just above the mouth of the Luhe River, is a black light buoy, which exhibits an occulting white light every 10 seconds; replaced during the ice season by a black conical buoy.

A red spar light buoy marked "Krautsand," and exhibiting an occulting white light every 10 seconds, is established on the western side of the channel, ½ mile northwestward of the north extremity of Pagen Sand.

Two of the buoys marking the south side of the Bönhasensand are light buoys, each showing an occulting white light every 10 seconds. In winter, when ice is in motion, these buoys are replaced by wooden buoys with topmarks.

Stör River flows into the Elbe about 2½ miles below Glückstadt. The entrance channel, which is liable to change, is buoyed in accordance with the German system.

There is a depth of about 7 feet on the bar at low water within which the depths increase.

Wewelsfleth, on the right bank of the river, about 2 miles above the outer buoy, has several small building slips.

Pilots and tugs for this river can be obtained at Glückstadt.

Glückstadt, situated on the river, about 12 miles above the entrance to Kaiser Wilhelm Canal, has an outer and an inner harbor connected by gates, with a depth of 18½ feet on sill at high water. The outer harbor has a maximum depth of 19½ feet at high water. The inner harbor is 1,968 feet in length by 230 feet in breadth, with a depth of 10 to 16½ feet at high water. Both harbors possess quays with facilities for loading small craft. The place has lost its importance as a winter harbor now that ice breakers are able to keep the channel free to Hamburg. There is railway communication with Hamburg and Itzehoe.

There is a storm-signal station near the lighthouse.

Tides.—See General Tide Tables.

Brunshausen, about 10 miles above Glückstadt, about 40 miles above Cuxhaven, and about 17 miles below Hamburg, is of importance as being the stopping place for such vessels that can not ascend to Hamburg. Here they lighten if wishing to proceed up, or if of very heavy draft discharge and receive cargo and supplies from the anchorage.

Anchorage.—The roadstead extends about 2.3 miles northward from abreast Stader Sand Lighthouse, and affords anchorage in 3¾ to 6 fathoms. In the anchorage a clear passage must be left of 100 yards on each side of the line of Stader Sand and Bassenfleth lights in one.

Compass adjustment.—Opposite Brunshausen, about 17 miles below Hamburg, is a gray can buoy in about 3 fathoms at low water. From it the true bearing and distances of the following objects are: Wedel Church, 117° 24′, distant 6½ miles; Steinkirchen Church, 150° 36′, a little over 5½ miles; Hollern Church, 164° 30′, distant 2.8 miles; and Stade Church, 228° 24′, distant nearly 3 miles.

Explosives.—Below Brunshausen, opposite Butzflether Sand, two gray mooring buoys lie on the east side of the channel to mark the anchorage for vessels with explosives. The anchorage is eastward of the line joining the two buoys.

Brunshausen lights.—A fixed white, red, and green light, elevated 48 feet above high water, is exhibited from the tower of the water gauge at Brunshausen. (See Light List.)

Lights elevated 46 feet and visible 7 miles are exhibited from red iron-framework beacons placed on the northwestern and southeastern end of a row of dolphins erected in Brunshausen Roadstead for berthing vessels of deep draft belonging to a large private line. Brunshausen is a telegraph station.

Storm signals are shown.

Eastward of the Este River, which runs into the Elbe nearly opposite Blankenese, the Elbe divides into two arms, Norder Elbe and Süder Elbe, forming between them several small islands.

The Norder Elbe leads to Hamburg and the Süder Elbe to Harburg, but this latter port is usually reached by the Köhlbrand, opening opposite Altona, which has deeper water.

Directions—Brunsbüttel Road to Hamburg.—The least depth in the cuttings through the various bars is about 25¼ feet at low water springs and 31¾ at high water springs, but is liable to change.

The positions of the banks are constantly changing, and although the buoyage and sectors of the lights are altered accordingly the channels are narrow and the navigation intricate, so that no stranger should attempt to reach Hamburg without a pilot.

Port of Hamburg—General remarks.—Hamburg, the most important of the German ports, is the commercial emporium of the Empire and the greatest mercantile port on the Continent of Europe.

Harbor accommodation—Depths.—The harbors and all appertaining thereto are the property of the Hamburg State.

There is a water area of 950 acres, quay and wharf accommodation, 8 miles for seagoing vessels and 17 miles for river boats. There are some 400 cranes to facilitate the loading and unloading of vessels and about 50 acres of warehouses and storage sheds.

Havens.—The principal havens on the south side of the river, commencing from the westward, are:

Kaiser Wilhelm Haven, about 1,100 yards long and 220 yards broad, with a depth of 24½ feet at low water springs.

Kuhwerder Haven, of about the same dimensions as Kaiser Wilhelm Haven, has a depth of 22 feet. Both are leased to a private steamship company.

Ross and Oder Havens. On the west side of the former is the Vulkan shipbuilding yard.

Petroleum Haven, with 19½ feet.

The India Haven, 1,100 yards long and 140 broad.

Hansa Haven, with 22 feet water, is 1,860 yards long, 130 yards wide in the entrance, with a maximum width of 420 yards.

Segelschiff (sailing ship) Haven has 22 feet in the northern and 20.6 feet in the southern portion, over a bottom of soft mud; it is

1,400 yards in length, about 300 yards in breadth, and 160 yards wide in the entrance.

On the north side of the river the Sandthor Haven, with a depth of 16½ feet, is 1,100 yards long and about 90 yards broad.

Grassbrook Haven, also with 18 feet, is 760 yards long and 80 yards wide in the entrance, increasing to 150 yards at the eastern end.

Baken Haven, with 19 feet, soft-mud bottom, 1,475 yards in length and about 120 yards in breadth. Some of the river quays, the Strand Haven, etc., have 19 feet alongside at low water.

There are numerous other havens of less size and depth than the above on both sides of the river.

Vessels either lie alongside the quays or are secured to dolphins, where they load or discharge from lighters, some of which carry as much as 1,800 tons.

Heavy drafts.—Vessels of heavy draft remain or lighten to 24 feet at Brunshausen, about 17 miles below Hamburg.

There is a free zone in the port of Hamburg.

Docks.—Hamburg has several floating and graving docks; one 720 feet in length (840 feet with low pontoons), 120 feet inside width, with a depth on blocks of 30 feet; it has a lifting power of 35,000 tons and is moored in the entrance to Kuhwerder Haven; another, of 36,000 tons lifting power; length over all 722 feet; clear width for docking, 108¼ feet; depth over sill, 33½ feet, and over blocks, 29½ feet. There are several patent slips that can take vessels of from 400 to 1,150 tons. (See Appendix.)

Lights.—For lights in the various havens, see Light List and chart.

Tides.—The high water interval at Hamburg is 5 h. 11 m.; springs rise 6½ feet, neaps 6 feet. The water rises for 4 h. 39 m., and falls for 7 h. 46 m.

The canals connecting with Hamburg afford free and uninterrupted communication with the Baltic, by the basin of the Oder, and through North Germany by the Vistula into Poland, etc.

The city of Hamburg is principally on the right bank of the Elbe, about 70 miles from its mouth. At one time it was surrounded by strong walls, but these and all the fortifications connected with them have been leveled and the space which they occupied converted into spacious roads and gardens.

The principal buildings are the church of St. Nicholas, a noble Gothic structure, with a lofty tower and spire; St. Peter's Church; St. Michael's Church, with a spire 456 feet high, and consequently one of the loftiest in Europe; St. Cothenues, with a spire 390 feet high; and two English churches; the exchange, a noble edifice, besides numerous other structures devoted to literature, science, and art.

The city of Hamburg was incorporated in the German Customhouse League in the year 1888, but a large portion on the northern shore of the Elbe, including the public quays and the greater part of the southern shore, remains a free port, so that vessels and cargoes coming to or leaving Hamburg will not be subject to the customhouse regulations. The free port is separated from the town by a canal. It is one of the principal German emigration ports.

In 1913 the population of Hamburg and its suburbs, not including Altona, amounted to about 1,031,000.

Altona adjoins Hamburg and is practically the western portion of that city; it is, however, in Schleswig-Holstein, and is the most populous town in that province; it contains about 173,000 inhabitants.

Trade.—Hamburg does not depend much on manufactures; it produces, however, linen, cotton, and silk goods, soap, tobacco, refined sugar, iron, tin, and copper ware, etc. The trade is very extensive, including, to a greater or lesser extent, every article which Germany is able to sell or requires to buy, and is greatly facilitated by means of communication both with foreign countries and with the interior. There is a considerable fishing trade.

The imports consist of coffee, tea, cocoa, rice, tobacco, cotton, indigo, dyewoods, wines, spirits, spices, coal, corn, cattle, oil, oil cake, tallow, hides, wood, iron, copper, guano, silk, flax, hemp, linen, wool, manufactured goods, fish, etc.

The exports consist of grain, seeds, butter, wool, salt, provisions, cattle, and other local produce above mentioned, German manufactures of all kinds, Rhenish wines, sugar, etc.

Communication.—There are regular steamers to all parts of the world.

Railways connect Hamburg with all the outports and with Berlin, etc. There is telegraphic communication with all parts of the world, and the telegraph office is always open.

Supplies—Coal.—All kinds of supplies are obtainable, including any quantity of coal; about 12,000 tons of the latter are kept in stock. Fresh water can be obtained from the main at the east end of St. Pauli landing stages or from a water tank alongside.

Repairs.—There are building yards, in which ships of large size are built. There is also the Reiherstieg Iron Ship & Engine Building Yard, where sailing and steam vessels of large size have been built. The Vulkan Shipbuilding Co. has established a yard on the south side of the river, where it will be possible to construct vessels up to 1,000 feet in length and 100 feet beam. On the banks of the river, in the vicinity of and below Hamburg, there are other yards where vessels of moderate size and small craft are built and can be repaired. Repairs of every description or to any extent can be carried out.

There are one or more cranes capable of lifting 150 tons.

Quarantine.—Vessels undergo medical inspection at Cuxhaven.

Hospital.—There is a hospital near the harbor for the exclusive use of seamen at a low charge; also a sailors' home, and a special British sailors' institute. If medical assistance is required, it can be obtained, by day, by exhibiting a flag on a pole with the flag tied up.

Time signals.—A time signal is shown on the tower of a storehouse on the Kaiser Quay, 180 feet above high water and 170 feet above the ground.

Ten minutes before the signal a black ball is hoisted halfway up, and at 3 minutes before close up. The time ball is dropped at 1 h. 00 m. 00 s., mid-European mean time (fifteenth meridian), corresponding to 24 h. 00 m. 00 s., Greenwich mean time. Should the signal fail, a black cylinder is shown until the black ball is lowered.

The under-mentioned additional means of obtaining the time have been established at the head of the Kaiser Wilhelm Haven, Hamburg:

(*a*) A standard clock, electrically connected with the observatory and which shows mid-European time within 1 second, has been placed in a special clock house erected on the Reiherdamm. This clock it situated about 1,150 yards 113° from the fixed light on the head of Kronprinz Quay.

(*b*) An electric-light time signal has been established in a triangular lantern, surmounting an iron framework, erected on the tower of the electric center 70 yards westward of the standard clock. An incandescent light is placed at each corner of the lantern to distinguish it from the other lights in the vicinity.

The electric light, in form of a horizontal streak, is lighted and extinguished automatically at the following mid-European standard times: Lighted five minutes before and extinguished at 6 a. m., noon, 6 p. m., and midnight.

Should this apparatus be disabled, a red ball will be hoisted above the lantern.

Electric-light time signals are exhibited from a tower erected on St. Pauli landing stage at 150 yards southwestward of the Seewarte.

These signals are the same as those exhibited at the head of Kaiser Wilhelm Haven, and are automatically regulated by a clock, which is in electric connection with the standard clock of the observatory and may be relied on to 1 second.

A clock on the tower shows standard mean time and can be relied on to 30 seconds.

Storm signals are shown, both by day and night, from the roof of the Deutsche Seewarte, on the north side of the river, near the east end of the St. Pauli landing stages. Storm signals are also shown near the steamboat pier at Altona.

Harburg, on the Süder Elbe, is situated 4 miles southward of Hamburg. The dredging operations in the river have brought the port up to the requirements of modern times. Vessels up to 4,500 tons burden now load and discharge at this port. Bridges across the river connect it with Hamburg, and there is an electric tramway. The telegraph office is always open.

There are two closed basins, entered from the river by locks; that leading to the Petroluemhafen is 143 feet in length and 29 feet in width in the entrance, with a depth of 14 feet on the sill at high water; the lock leading to the eastern basin or Verkehrshafen is 229 feet in length, 55 feet in width, with 17¼ feet on the sill at high water springs. The average width of the Petroleumhafen is 490 feet and of the Verkehrshafen 590 feet. At high water vessels of any length can pass through the locks.

Three new tidal docks have been constructed, in which the depth is 32¾ feet at ordinary high water.

The new channel of approach to Harburg is entered from the Elbe at about 600 yards westward of the mouth of the Kahlbrand, which it rejoins at Waltershof.

This channel is 330 yards broad, with depths of from 20 to 24 feet, and is marked by three red buoys.

The channel through the Kahlbrand is closed and the buoys and light removed.

Lights.—(For harbor lights, see Light List and chart.)

Elbe Trave Canal, which connects the Trave River with the Elbe, runs from Lubeck in a southerly direction and joins the river last mentioned at Lauenberg. This canal, a section of which is formed by the lake of Mölln in Lauenberg, is 42 miles in length, from 105 to 128 feet in breadth at water level, 72 feet in breadth at bottom, with a minimum depth of 8¼ feet. There are seven locks, 262 feet in length, 56 feet in breadth, and 39 feet at the gates. Tugs are provided which will tow a craft through in from 18 to 21 hours.

Norder Elbe.—The opening, about 2 miles wide, between the north side of Grosser Vogelsand and the flat of Busch Sand, known as the Norder Elbe, leads by tortuous and shallow channels, only available to coasting craft with local knowledge, to the shore known as Kaiser Wilhelm Koog and Dieksand or Friedrichs Koog, where a lifeboat is stationed. The northern branch is the Falsches Tief, which, about 3 miles from the Busch Sand, turns southward, and is buoyed as far as the Elbe, which it joins at about 1.3 miles northward of the Elbe No. V Light Vessel. This channel is also shallow and very subject to change and is used by small craft trading between the Elbe and the west coast of Schleswig-Holstein. The south side of the approach to the Norder Elbe is marked by the Grosser Vogelsand Buoy and Elbe Outer Light Vessel.

CHAPTER VII.

ELBE RIVER TO HORN REEFS.

(See note at beginning of Chapter V.)

Coast—Aspect—General remarks.—The greater portion of the coast between the Elbe River and Horn Reefs consists of low marshy ground enclosed by dykes, sheltered by a range of islands and sand banks, and surrounded by extensive flats, which partly dry at low water, leaving narrow channels between them. The islands are known as the North Frisian Islands.

The western side of the outer islands, as also the coast of Eiderstedt in Schleswig, consist of sand dunes, and on the whole extent of this coast there are but few objects sufficiently high to be visible from a vessel outside the channels, except the beacons.

The principal traffic is by the Eider, during the summer months, and consists in the export of cattle from Tönning. The traffic on the Hever is chiefly through Husum, which can only be reached by flat-bottomed vessels of light draft.

There is regular communication by steamers between Sylt, Föhr, and other islands from the towns or villages on the adjacent coast, and they are also included in the German telegraph system.

Pilots.—On this coast pilots are established at the mouth of the Eider River and at Graa Deep. Those at the former station are required to take vessels to the Hever also. For other places vessels must avail themselves of the services of fishermen, boatmen, or others acquainted with the channels in the locality bound for.

Buoys and beacons.—The buoyage of the channels on this coast is in accordance with the uniform system adopted by Germany. The buoys are altered to meet changes in the channels when necessary; during winter some are removed, spar buoys in some cases being placed instead. The inner shallow channels or gutters through the flats are marked in summer by stakes for the use of local small craft.

Tides and tidal currents.—The rise of the tide increases southward from the Horn Reefs to Helgoland Bight. (For tides see General Tide Tables.)

Outside the islands, as well as between them, the tide flows and ebbs every six and a quarter hours; but frequent irregularities occur from the influence of strong winds, particularly those from the eastward and westward. The highest tide takes place at the third transit after the full and change; but experience shows that the westerly winds occasion a higher and easterly winds a lower tide nearly in proportion to the force of the wind.

In the offing, at from 10 to 15 miles from the islands, the current is never slack, but takes a rotary character. The ebb current sets first northwest by north, then works round through northwest to west-southwest. The flood first sets south and works round to southeast by east, shifting through east and north when the ebb makes.

On the west shore of Sylt the ebb current sets northward from Hörnum and southward from Lister Deep, meeting off Westerland; and the flood current, separating at this point, flows south and north round those points of Sylt. These currents extend about 4 miles offshore.

Anchorages.—Those in small craft, acquainted with the inlets, and fishing vessels seeking refuge in bad weather, anchor at the following places; but it is not advisable for strangers to seek for anchorage between Horn Reefs and the Elbe.

In the Eider, shelter is found south of Vollerwiek.

In the Hever there is anchorage under Pelworm Island, and only southwest winds raise a sea. It is quite sheltered under Nordstrand Island, but the space is confined.

In Schmal Deep, under Seesand, but here little shelter is afforded in westerly gales. In Norder Aue, off Amrum, and in Wyk Road, sheltered anchorage is found, except in winds from between south and southwest; also in Vortrapp Deep under Hörnum, the southern part of Sylt Island.

Lister Deep is the easiest accessible and has safe anchorage off Königs Hafen, sheltered from all winds.

Süder and Norder Piep are channels between the extensive shallows westward of Ditmarschen, leading to the havens Büsum, Warwerort, Wöhrdener, Meldorf, and Barlter. They are separated by the Tertius Sand and Mittel Plate, the greater portion of which dries from 3 to 5 feet at low water.

Süder Piep has at its entrance a sufficient depth for vessels of deep draft, and thus affords anchorage and shelter with offshore winds. At the bar, about 10 miles from Büsum, the channel divides, one part, the Russen Loch, continuing toward Büsum, and the other, the Flackstrom, turning southeastward and ending in the sands which are uncovered at low water.

Norder Piep is barred by a flat, 1.3 miles wide, having a depth of 10 to 12 feet at low water springs, distant 17 miles from Büsum.

Depths.—The least water in the buoyed channel over the bar of the Süder Piep is 2¾ fathoms at low water between buoys 3 and F. The depths are subject to change.

The Süder Piep connects with the Norder Piep by means of the Russen Loch, a narrow bouyed channel with depths of 4 to 8 fathoms.

Inside the 1¾ fathoms bar of the Norder Piep the depths to abreast Büsum vary from 4 to 9 fathoms at low water.

Busch Sand Islet is situated near the western extremity of the flats extending 7 miles from the shore, south side of the Süder Piep and eastward of Falsches Tief. It is 3 miles long north and south and about ¾ mile broad in the center.

Trischen Islet.—On the eastern part of Busch Sand is Trischen Islet, 18 feet in height and 1½ miles in length. The islet is inhabited.

Refuge beacons.—On the northern part of Busch Sand Islet is a refuge beacon, 67 feet high, consisting of a mast with four supports carrying a triangle of trellis, with a sphere above it. The beacon is fitted with a chamber containing bread and water for shipwrecked crews; there is also a flag which can be hoisted as a signal for assistance.

On Blauort Sand, on the northern side of Norder Piep, there is a similar structure, 69 feet high, carrying on the top a cube of trellis-work. From this beacon the nearest inhabited land is Hedwigen Koog, 3.3 miles to the eastward.

Buoyage.—Süder Piep distinguishing buoy is a red beacon buoy, with "Süderpiep" on it, surmounted by two balls as topmark, and situated about ½ mile westward of the 3-fathom edge of the shallow water, south side of Süder Piep. The channel within and through Russen Loch is marked by lettered red spar buoys, each surmounted by a ball, except E buoy, which has a cube on the starboard hand, entering from seaward, and by numbered black conical buoys on the port hand. The inner port-hand buoy is a beacon buoy with a ball as topmark (in winter, two brooms), and is moored off the eastern extension of the Mittel Plate at the junction of the Russen Loch with the Norder Piep. No. 1 black buoy is nearly abreast the outer light and bell buoy. From buoy F inward the starboard hand red buoys have a broom as topmark in winter.

The under-mentioned light buoys have been established in the Süder Piep:

1. A light and bell buoy, painted black, and marked "Süderpiep 1," exhibiting a group occulting white light, showing groups of 2 eclipses every 11 seconds, is moored, in a depth of 6 fathoms at low water, to the westward of the bar.

2. A light buoy, painted black, marked "No. 5a," exhibiting a group flashing white light, showing groups of 2 flashes every 8 seconds, is moored, in a depth of 3¼ fathoms at low water, inside the bar.

3. A light buoy, painted red and marked "M 1," exhibiting a flashing white light every 3 seconds, lies in a depth of 5 fathoms near buoy M.

A light buoy exhibiting a group occulting red light is situated at the western entrance to Russen Loch.

The above light buoys will be withdrawn on the formation of ice.

A red beacon buoy, with cube as topmark, is moored on the south side of the entrance to the Flackstrom, south side of Süder Piep.

The red spar buoys on the southern side of Flackstrom, marked with the letters "A" to "G," have each two balls as a topmark.

Norder Piep distinguishing buoy lies close to the northwest edge of the bar in about 5 fathoms. It is a black buoy, with "Norderpiep" on it, and surmounted by a ball. The channel within is marked by numbered black conical buoys and stakes on the port hand and by two red spar buoys with ball as topmark northward of Tertius Sand on the starboard hand entering from seaward. In winter the spar buoys have a broom as topmark.

Tides.—The high water interval at Blauort Sand is 0 h. 38 m.; springs rise 12 feet, at Busum 0 h. 53 m., springs rise 12 feet.

Anchorage.—Shelter for small craft from all winds can be had in Russen Loch, in the Süder Piep, and from all winds except westerly in the Norder Piep.

Directions.—By paying attention to the soundings, and to bearings of Helgoland, the outer light vessels of the Elbe and Eider, Busch Sand and Blauort Sand beacons, and the large tower of Neuwerk, the mariner will, provided it is clear weather, be able to shape a proper course for the entrances to the Süder or Norder Piep, where a pilot should be obtained, if not picked up beforehand. The course must be directed by the buoys in the channel. Between Nos. 1 and 5a light buoys the ebb current sets northward and the flood southward.

Büsum Haven is narrow and about 200 yards long; it has a depth of about 6½ feet at high water ordinary springs, and dries nearly 6 feet at low water. It is open only to the southward and is approached by a gutter, marked by stick beacons.

Büsum is a sea-bathing place and is connected with the railway system. Crab fishing is the principal industry.

There are several gutters into the Eider across the watts or flats but only practicable at high water to small craft. They are marked by stick beacons and are subject to frequent changes.

Lifeboat.—Büsum Haven is a lifeboat and day storm-signal station. The lifeboat can leave the harbor from three hours before to three hours after high water.

Storm signals.—Night storm signals, by means of a red light, are exhibited from a flagstaff at Büsum.

Büsum lights.—A fixed red light, visible about 2 miles, is shown, 14 feet above high water from a pole at the head of the west pier of Fishing Harbor.

A group occulting light, with white and red sectors, 72 feet above high water and visible 14 miles, is shown from a black lighthouse situated on the east side of the Fishing Harbor.

A beacon light is shown from a perch close southwestward of the gutter leading to Büsum Haven.

Other small havens.—From abreast Büsum the shallow channel continues to Warwerort Haven, marked by stick beacons on the port hand. The haven is formed between two wooden piers of short extent, and a few posts to make fast to are placed along its edges. The depth in the harbor at ordinary high water is 8 feet, and it dries 4 feet.

The channel continues to Wöhrdener, which is distant 2 miles from Warwerort. Craft drawing 5 feet may enter this haven at high water, but it is difficult to leave under sail with westerly winds. Since König Christians Koog has been surrounded with dykes, craft may load or unload there, but the customhouse is at Wöhrdener.

Meldorf Haven, about 3 miles southward, has a depth of 10 feet at high water and dries 2 feet at low water.

Eider River discharges its waters between the far-extending shallows of the Ditmarscher Grund and of those projecting from Eiderstedt. It takes a somewhat tortuous course from Rendsburg (where it meets the Kaiser Wilhelm Canal), past the towns of Friedrichstadt and Tönning to the sea.

Caution.—The channel is always changing, and alterations in the buoyage of the river entrance are made to meet these changes. Strangers are cautioned on no account to attempt to enter the river without a pilot.

Navigable depths.—A vessel of 13 feet draft can usually navigate the channel from sea to Tönning at high water neaps. At low water with westerly and northwesterly gales, there are usually breakers on the bar, and no craft, however small, should enter; and with westerly winds there is a short high sea during the ebb current. The river is only suitable for small craft.

The depth on the bar at low water is about 2 fathoms, but the least water in the channel to Tönning, 16 miles above the Eider Galliot, is 1½ fathoms, about 2 miles below Tönning.

Ice.—The dates of the complete freezing as well as of the melting of the ice above Tönning differ greatly.

In 1889 navigation closed in the Eider on January 9; was still closed to sailing vessel on February 11, and on March 20 the upper Eider was full of drift ice. Navigation for steam craft opened on February 1. In the winter of 1906–7 the river was closed to sailing vessels on December 28; to steamers on January 26, and navigation reopened on February 28.

Observations extending over a period of eight years (1903–1911) show that on an average ice appeared in Tönning Harbor on from 28 to 31 days during the winter months.

Eider Light Vessel (outer) is moored in 7 fathoms about 8 miles outside the bar in latitude 54° 16′ N., and longitude 8° 18′ E. It has three masts, is painted red, with "Eider" in white letters on sides. The mainmast has a wireless telegraph mast; on the foremasthead is a black ball 72 feet above the water, and the mizzenmast has a yard for storm signals.

When not in position a black flag will be hoisted on the mizzenmast and the main light will not be shown.

When vessels are seen pursuing a wrong course guns are fired and flag signals made. The light vessel is sometimes removed for repairs and when there is heavy drift ice without any other vessel being substituted.

From the main is exhibited a fixed white light at an elevation of 36 feet (32 in bad weather), visible 8 miles. A riding light is carried on the forestay.

A red watch buoy lies ¼ mile east-southeastward of the light vessel. This light vessel is equipped with Morse night-signaling apparatus.

Fog signals.—A siren or foghorn is sounded. If both siren and horn are out of order, a bell will be struck.

A submarine fog bell is struck.

Signal station.—The light vessel is a signal station with which vessels can communicate by the International Code.

Radio.—Eider Light Vessel is fitted with radio for urgent matters affecting shipping only. Call letters K A J.

Storm signals are shown, by day only, from this light vessel.

Eider Galliot Light Vessel is moored inside the bar, in about 3¾ fathoms, about 11½ miles 104° from the outer light vessel. The vessel is painted red with a white streak, and "Eider" in white letters on sides, has three masts, and carries a black ball at the fore.

The light is fixed white, elevated 33 feet, and is visible 8 miles, exhibited at the main. A riding light is carried on the forestay.

Fog signal.—In thick weather a gong is struck.

If out of position, a black flag is hoisted by day, and the light is not shown. A gun is fired and flag signals shown if a vessel is seen standing into danger. The vessel is subject to occasional removal on account of ice.

The vessel is a pilot and lifeboat station.

The arrival of vessels, strandings, and other important occurrences within range of the galliot are reported to Tönning by means of carrier pigeons.

For minor lights up river see Light List.

Radio.—This light vessel has been equipped with radio apparatus; the call letters are K C L.

This station is only available to vessels in cases of urgent necessity.

The light vessel is also equipped with Morse apparatus for night signaling.

Pilot signals.—A white flag is shown at the mizzen when pilots are not on board.

The signal for a pilot should be made in good time. Pilots board vessels in the neighborhood of the galliot and speed must be reduced when approaching her, and proper means adopted to enable the pilot to board safely, especially in bad weather with a high sea from between southwest and northwest when the operation is attended with considerable risk.

If the galliot is off her station when navigation is not interrupted by ice, and as far as circumstances permit, a steamer with pilots on board cruises in and off the mouth of the Eider. This vessel is generally provided with carrier pigeons.

Pilotage is compulsory between the Eider Galliot and Tönning for vessels of more than 9¾ feet draft.

The pilotage charge varies according to the season, summer or winter, and also according to the distance piloted.

The pilots on board the Eider Galliot conduct vessels to the following places: Tönning, the Elbe, the Hever as far as Husumer Aue, and the Pieps as far as Busum Road.

The Jade and Weser pilots are acquainted with the Eider, but if employed, must give up charge when an Eider pilot presents himself.

Pilots can be obtained at Tönning and Rendsburg.

Storm signals.—Storm signals are shown from a mast on the dyke southwest of Süderhoft village, about 1 mile southeastward of St. Peter's Tower. Storm signals are exhibited at the schoolhouse in the village.

St. Peter Light, group occulting, with red sectors, is located on St. Peter Beacon, Eider River entrance.

Lifeboats.—There is a lifeboat on the Eider Galliot Light Vessel, one at Süderhoft, and one at Ording 3½ miles northward of St. Peter's Tower.

Landmarks—Beacon.—A masonry tower, about 31 feet high and about 15 feet in diameter, with a flattened conical roof, has been erected near the shore southward of St. Peter, north side of the Eider, as a seamark. Its summit is 71 feet above mean high water.

Other landmarks are the tall slender tower of Tating Church, standing back about 3 miles from the tower, also some large hotels and a bathing house on the shore about 2 miles northward of the tower.

Buoys.—The buoyage of the Eider is in accordance with the German uniform system. The outer fairway buoy in the approach is a black and red buoy, with "Eider" on it, and surmounted by a reflector over a ball placed in 5½ fathoms fathoms 107° 5½ miles from the outer light vessel.

The inner fairway buoy, 2½ miles nearer the bar, is a red beacon buoy, surmounted by a double ball. Within this buoy, the starboard side of the channel, entering from seaward, is marked by lettered red spar buoys with topmarks, mostly balls and poles, and the port side by numbered black conical buoys, some of which have topmarks.

The buoys in the channel are shifted to suit the changes which sometimes take place.

Tides.—(For tides at the Eider River entrance and at Tönning, see General Tide Tables.)

Tidal currents.—At Eider Light Vessel the flood current, general direction 102°, runs from four and three-quarters hours before till one-half hour after high water at Dover; its greatest velocity is at two and one-half hours before high water at Dover, at which time the mean velocity at springs is 1¼ knots, and at neaps ½ knot; the greatest velocity ever observed at this time was 1½ knots.

The ebb current, general direction 282°, runs from one and one-quarter hours after till five and one-half hours before high water at Dover; its greatest velocity is four and one-half hours after high water at Dover, at which time the mean velocity at springs is 1¾ knots and at neaps ½ knot.

The mean duration of slack water is about three-quarters of an hour.

At Eider Galliot the flood current runs from four and one-half hours before till one-half hour after high water at Dover, and the ebb current from one and one-half hours after till six and one-half hours after high water at Dover.

Anchorage.—The best anchorage for vessels unable to leave the river on account of wind or insufficient depth of water is in the channel southeastward of Ehstensieler Flat.

Abreast Vollerwiek there is a good roadstead or stopping place for small craft to await a change of wind or tide.

Directions for the Eider.—On approaching the entrance to the Eider along shore, the objects that will be recognized if the weather be clear, are the steeple of Tating Church, St. Peter's Mill and Tower, and Wesselburen Church, in Norden Ditmarschen. By bearings of these landmarks the position of a vessel may be ascertained. From the westward a departure should be taken from Helgoland for making the Eider or any other of the inlets between the Hever and the Elbe.

Approaching the Eider from the westward, Helgoland Lighthouse kept bearing 260° will lead about 2.3 miles southward of the Eider Light Vessel and to the outer fairway buoy. Near the mouth of the river depth is 4½ to 6 fathoms fine gray sand. Southward of the outer light vessel blue mud will be found in 6 to 7 fathoms. Further northward the soundings are gray sand with specks.

Approaching from the northward or southward the Eider Light Vessel should be steered for, and the depth not shoaled to less than 6 fathoms at low water. When the vessel's position is ascertained, a course may be shaped for the outer fairway buoy, thence to the inner fairway buoy and across the bar on a 107° course between the red and black buoys to the Eider Galliot, which may be passed on either side, and near which a pilot should be obtained, the necessary signal having been previously made.

Between Vollerwiek and Tönning the channel is named Purren Ström, the last 2 miles of which is known as the Tonninger Rack. It is little more than 200 yards wide, with a least depth of 1½ fathoms. The lower half of the channel is marked by perches on the starboard hand and black buoys on the port hand, and the upper half by perches to port and red buoys to starboard, ascending the river.

Two fixed white range lights in front of Vollerwiek and also those at Tönning are intended to lead through separate portions of this channel.

In the road abreast Tönning Harbor there is a depth of 18 feet at low water.

Tönning Harbor is a narrow tidal basin from 300 to 400 yards in length, and is nearly dry at low water; however, the bottom being ooze, vessels are not injured by grounding. At high water the depth is 12 feet in the middle of the harbor.

There is a slip capable of taking up vessels of 8 to 9 feet draft for repairs, and a shipbuilding yard capable of building iron vessels 300 feet long and of 4,000 tons displacement. There are cranes of 2 and 8 tons lifting capacity for loading and discharging cargo, and a 75-ton sheers.

A coaling jetty extends into the river just below Tönning.

A railway connects Tönning with the towns inland; that connecting with Heide and the south starts from the opposite side of the river, which is crossed by a steam ferry. There is telegraphic communication with the interior.

Trade.—The shipping trade of Tönning is principally with the harbors on the neighboring rivers, the east coast of Great Britain, Norway, and the Baltic.

Tugs.—A tug is stationed at Tönning. A vessel approaching the river and requiring her services should signify the same to one of the light vessels, which will requisition the tug from Tönning by telegraph or pigeon post. The vessel towed usually provides the towing hawser.

Supplies.—Provisions can be obtained; fresh water is scarce.

Coal.—About 1,000 tons are kept in stock.

Storm signals, both day and night, are shown from a signal post abreast the harbor.

The Lower and Upper Eider.—The Lower Eider from Tönning to Rendsburg is in general practicable to vessels of about 10 feet draft. The shoalest places are in Breiholz Reach, where from a continuance of easterly gales the depth may be considerably reduced. Below Friedrichstadt the river is crossed by a railway swing bridge, which is only opened to allow vessels to pass.

Friedrichstadt Harbor has a depth of 16 feet and Rendsburg Harbor 11 feet at high water.

The navigation between Friedrichstadt and Rendsburg is difficult and is more frequently performed by tracking the craft along in other than steamers.

The lock connecting the Eider with the Kaiser Wilhelm Canal at Rendsburg is 223 feet in length and 39 feet in width, with a depth of 17 feet. Both gates are occasionally opened when the water is level.

The Upper Eider is that part of the river above Rendsburg and joins the Kaiser Wilhelm Canal about 1½ miles eastward of that place.

Hever River.—The estuary of the Hever is almost blocked by the shallows known as the Rochelsteert, and Aussen Quage, extending from the land of Eiderstedt on the south, the Norder and Innen Quage and Pahls Knoll in the center, and the Süderoog Sand extending from Pellworm on the north to the distance of 9 or 10 miles offshore.

Depths.—**Middle Hever** is now the principal channel through these sands and becomes the Hever Strom after its junction with the South Hever. It is buoyed up to Husum Road, abreast Nordstrand Island; also to Pellworm by the Norder Hever. There is a low water depth of about 2½ fathoms on the bar, subject to change.

South Hever is also buoyed up to the junction with the main stream. It has apparently 3 feet less water than the Middle Hever and is narrow and tortuous in places.

Old Hever, situated northward of Middle Hever, is partially buoyed; the two buoys, which are withdrawn during winter, are a red beacon buoy marked Alte Hever and a red spar buoy with cone topmark. There is a depth of 2 fathoms on its bar, subject to change.

In the river there are depths of 6 to 12 fathoms in places.

Vessels of 9 feet draft can reach Husum about 25 miles above the bar at high water.

Pilots for the Hever River can be obtained from the Eider Galliot.

Landmarks—Beacons.—St. Peter's tower may be of service when making for the Hever, but it is 9½ miles within the 2-fathom edge of soundings on the Rochelsteert, and therefore may not be seen.

Pellworm tower (an old church), on the west side of that island, may also assist the navigation of this low and dangerous coast when approaching from the northward.

Süderoog is a conspicuous black refuge beacon erected on Süderoog Sands northeast of the entrance to the Hever River, visible 9 miles. The beacon is 72 feet high and above the shelter room has a four-sided latticework covering in the form of a blunt pyramid, the top closed by a cupola, surmounted by a ball as topmark.

Westerhever Light, fixed white and red and group flashing white, elevated 136 feet above high water, is exhibited from an iron cylindrical tower, painted red with two white bands, situated on the Westerhever Sand, 1,100 yards westward of the sea dyke on the northwest part of Eiderstedt. The fixed white and red lights are visible 17 and 11 miles, respectively, and the flashing light 15 miles.

Pellworm Range Lights—Rear light.—An occulting white electric light, elevated 120 feet above high water and visible 17 miles, is exhibited from an iron cylindrical tower painted red with a white band in the center, erected behind a dyke on the south side of Pellworm Island.

Front light.—An occulting white and red light, elevated 46 feet above high water, is exhibited from a red iron framework support, situated on the sand southward of Pellworm Island and 223°, 1,640 yards, from the rear light.

Ochsen Sand Light, fixed red and white, elevated 20 feet above high water, is shown from a pile beacon on the southeastern side of Ochsen Sand, at a distance of 1,400 yards 133° from Pellworm rear occulting light.

Buoys.—The buoyage of the Hever is in accordance with the German uniform system. The South Hever distinguishing buoy is a black and red beacon buoy, with "Süder Hever" on it, surmounted by an hourglass topmark, in about 6 fathoms, and ½ mile southwest of Rochelsteert, south side of approach. The channel within, as far as the junction with the Middle Hever, is marked on the starboard side by lettered red spar buoys with hourglass topmarks and on the port side by numbered black conical buoys when entering from seaward.

The Middle Hever Buoy is a red beacon buoy, with "Mittel Hever" on it, surmounted by a ball and hourglass, in about 4 fathoms, and ½ mile northward of the west extremity of the Norder Quage Bank, with 3 fathoms, forming the south side of the bar. Within this buoy the channels of the Middle Hever and Hever Strom are marked by lettered red spar buoys with ball topmarks on the starboard side, entering from seaward, and by numbered black conical buoys on the port side. The junction of the South and Middle Hever Channels is shown by a red beacon buoy marked "Süder Hever."

The positions of all these buoys are liable to be changed.

A pilot's assistance is essential.

The wreck of a scow lies between Buoys 9 and 10 in Hever Strom; it is marked by a green buoy on the western side.

Storm signals are shown from a mast on the east coast of Pellworm Island and also at Husum.

Pellworm is a low island, 4½ miles in length east and west and 3 miles broad, situated on the northern side of Norder Hever, and is surrounded by watts, or sands, dry at low water. On the eastern side is a small harbor, with a depth of 6 feet at mean high water, approached from the Norder Hever by a narrow channel marked by stakes, in which the depth is 5 feet at low water. When the watts are covered the tidal currents set across the channel. Off the entrance there is anchorage in from 3½ to 5 fathoms, with deeper water farther out, in the Norder Hever.

There is steamboat communication with Husum and telegraphic communication with the neighboring islands.

Nordstrand, an island about 4 miles in extent, lies southeastward of Pellworm, between the Norder Hever and Hever Strom, and is also surrounded by sands, dry at low water. At its southeast point is Morsum Hafen, available for small craft at high water, approached from the Hever Strom by a channel about 670 yards in length, marked on its south side by stakes. The tidal currents set across it.

Two small fixed white range lights are shown when required to mark the approach to the harbor.

There is daily steamboat communication with Husum, 4 miles distant, and telegraph cables are laid to the mainland and Pellworm.

Anchorage.—There is a small anchorage in Husum Road abreast Morsum Hafen on Nordstrand in 18 feet at low water and good holding ground sheltered from all winds, but there is little room to swing.

Husum is situated on the north bank of the Husumer Aue, a tributary of the Hever River. On the bar of the Husumer Aue there is a depth of 13 feet at high water.

About ½ mile below the town the river is closed by a lock 26 feet broad. With the river at its average height vessels of 9 feet draft can pass the lock and enter the still water above, which is called the harbor, and has stone and timber quays. The harbor is crossed by a railway swing bridge. It possesses two cranes, one equal to 12 tons. There is a small coal store. The telegraph office is always open.

Signals.—By day, when the swing bridge is closed and navigation stopped, a red disk, with white border, visible from both up and down the river, is shown from an arm placed vertically. When the disk is placed horizontally navigation is open.

By night a red light is a signal for vessels to stop, and a white light that they may proceed.

There is also a basin, fitted with gates, which can be emptied at low water, and in which small vessels can be docked.

Husum Sluice, which usually stands open, is closed at high water. This is indicated in the daytime by a ball, and at night by a white light, hoisted at the sluice.

A large wind motor at Husum forms a good landmark.

Trade.—The principal traffic is the export of cattle; and during the summer months there is regular steam communication with the off-lying islands. There are two railway stations, one on each side of the harbor, connected by the bridge above mentioned.

Repairs.—Small repairs to vessels and machinery can be made.

Tug.—A tug is stationed at Husum; also a salvage steamer.

Supplies.—Provisions and fresh water can always be obtained; the latter from a hydrant near the quay.

Tides.—It is high water, full and change, at Husum at 2 h. 04 m., springs rise 10¾ feet, neaps rise 11½ feet; and at Pellworm at 1 h. 50 m., springs rise 10¾ feet. The flood sets in the direction of the channel.

Directions.—Those approaching the entrance of the Hever from the westward should get a departure from Helgoland; those from the northward may be guided by bearings of the lighthouse on Amrum Island, the Amrum Bank Light Vessel, and the beacon on Süderoog Sand; and those from the southward by bearings of Eider Light Vessel and St. Peter's Tower on the main. When shaping course from the Eider Light Vessel to the Middle Hever Distinguishing Buoy, the set of the flood current toward the bank must be allowed for.

Close outside the mouth of this river and southward of it there are depths of 5 to 6 fathoms, fine gray sand, with shells and black specks in places, and, in anything like clear weather, the shore at Ording and St. Peter is visible though the sand dunes are low. Northward of the Old Hever entrance the depths are similar to the above, but the bottom is of fine brown sand. A strip of soundings of about 8 fathoms, with similar bottom, lies in a north and south direction about 5 miles outside the Middle Hever Distinguishing Buoy, across the track of vessels bound to the Hever from northward of Helgoland.

The tower south of St. Peter, St. Peter's Church and mill are the most conspicuous objects, and in very clear weather Ording Church, with its low tower and short spire, shows between the sand dunes. Pellworm Tower may be just visible on the horizon.

The light shown from Westerhever Lighthouse and the range lights on Pellworm Island, together with the light on Ochsen Sand, enable the Middle and North Hever to be navigated at night as far as the road eastward of Pellworm.

It would only mislead to offer any particular directions for navigating the several channels of the Hever. Changes in the position of the banks are constantly going on, so that any given course of to-day might be the means of running the vessel into danger a short time hence.

Above Pellworm—Inner channels.—Holmer Fahre branches off from the Norder Hever abreast the north end of Pellworm and trends in an easterly direction toward the mainland for about 6½ miles, passing northward of Nordstrand. The depth in the entrance is 6½ fathoms, after which it varies from 1¾ to 4 fathoms for between 4 and 5 miles, when it becomes very shallow. The south side of the entrance is marked by a red beacon buoy, and the south side of the channel by perches.

Beens Ley, with a depth of 8 feet, and Der Strand, with a depth of about 11 feet at mean high water, are narrow channels, marked by perches on the west side, leading northward from the Norder Hever into the Süder Aue, across the sands. The depth in Der Strand has been obtained by dredging.

All the inner channels or gutters from the Hever River to Fanö may, as a general rule, be used at high water by coasters of 3 to 5 feet draft with local knowledge. These channels are ordinarily marked by stakes or perches with brooms. The Pohns Bucht Channel is closed to navigation, a dam having been built from the mainland to Nordstrand Island.

Approaches to Amrum.—Amrum Bank lies in the offing westward of Amrum Island. The main body or southern part of the bank is 5 miles in length, north and south, by 1½ miles average breadth, with depths of 3¾ to 5 fathoms. The center of the shallowest part lies with Amrum Lighthouse 87°, distant about 12½ miles.

Northeastward from the main bank and separated from it by a passage 1 mile wide, in which the depth is 6½ fathoms, is a series of detached banks with depths of 4¼ to 5 fathoms on them, which extend northeastward for 5 miles, with narrow intervals between them. The whole length of the bank is thus 11 miles.

The surface of the bank consists generally of fine white sand, mixed in places with gray specks. Off the bank the sea bottom consists of fine brown sand.

During clear weather the sand dunes on the south end of Sylt Island are visible, as also those along the west side of Amrum, among which the Saddle Dune is conspicuous. Amrum Lighthouse and Nebel Mill are also visible.

Amrum Bank Light Vessel exhibits a group flashing white light, elevated 52 feet above the sea, visible 12 miles. The vessel, which is painted red and marked " Amrum Bank " in white letters on the sides, has two pole masts, between which is a turretlike yellow superstructure about 3 feet in diameter, on the top of which is the lantern. Two riding lights will also be exhibited from the vessel.

Fog signal.—During thick or foggy weather a siren or foghorn is operated by compressed air or steam.

Radio telegraph.—A radio telegraph station has been established on this light vessel. Call letters K A F.

This station is only available to vessels in cases of urgent necessity.

A submarine fog bell is sounded.

Signals.—Storm signals and Morse signals for night signaling are exhibited from this light vessel.

Mariners desiring to practice receiving submarine signals must hoist on board their vessels a white flag with a large yellow bell; the light vessel in reply will hoist a similar flag when the bell is put in action, and keep it flying while the bell is sounding. German war vessels will hoist a white flag instead of the above signal.

If the light vessel is not in position, the distinguishing light will be discontinued and only the anchor lights exhibited at night, while by day a dark flag will be hoisted.

Buoy.—A red spherical station buoy surmounted by a red spar, carrying a triple reflector, is moored southeastward of Amrum Bank Light Vessel.

Amrum Island is about 5.3 miles long north and south and 1.8 miles broad at its widest part, near the center. Along the western side of the island is a line of moderately high dunes, the highest of which near the center of the island attains a height of 98 feet. The Saddle Dune, 95 feet high, so named from its form, is situated nearly 1 mile northward of the lighthouse at the south end of the island. On the southeastern end of the island are some light colored dunes, 55 feet high, named Wittdün. The north end of the island bends northeastward and becomes very narrow; about 1½ miles southwestward from the north point there is a gap in the dunes nearly 200 yards wide. The low part thus formed is named the Risum of Amrum and is remarkable from seaward. Föhr Island may be seen over it. From the southwest part of the island the Kniep Sand extends northward upward of 4 miles, forming a narrow spit, between which and Amrum is Kniep Haven, dry at low water. Amrum Island is a sea-bathing resort.

Piers.—There are piers at Wittdün, Steenodde, and Nordder.

Amrum Island Lighthouse, on the summit of the southwest part of the island, is a circular red-brown tower 137 feet high, from which is exhibited, at an elevation of 208 feet above high water, a group flashing white and red light, visible 21 miles.

Amrum Island Lighthouse is a telegraph, signal, and storm-signal station.

Amrum Light, at about 3 miles northwestward of the above light, is fixed white, red, and green, elevated 74 feet above high water, exhibited from a gray iron cylindrical tower 23 feet high situated on the west coast of Amrum Island. The white, red, and green lights are visible 14. 13, and 12 miles, respectively.

Old Schmal Deep, the approach along shore from the Hever for small craft bound to Amrum or places within, lies between Tusch Gründe and Süderoog Sands. It has about 7 feet water on its bar at low water springs, subject to change. It joins Schmal Deep at Buoy E of that channel, and is useful to sailing craft during northeast winds, when a vessel could not lie up Schmal Deep.

The outer buoy lies within the bar in about 3½ fathoms. It is a red and black beacon buoy with an hourglass topmark and the name Alt Schmaltief. The eastern side of the channel within it is marked by red buoys with similar topmarks. The west side has one black conical buoy. In winter the eastern side of the channel is marked by one red buoy only.

It is necessary when approaching in thick weather to keep the lead quickly hove, as the depths diminish rapidly from 6 and 4 fathoms to 2 fathoms or less on the banks in the entrance.

Schmal Deep is the deepest of the channels through the sand banks leading to Amrum, Langeness, and Hooge Island and to the mainland eastward of them, and is buoyed. Between the Rütergat and Vortrapp Deep is the Wester Brandung Bank, which dries 3 feet in places and is nearly always marked by breakers.

Schmal Deep has about 3 fathoms of water on its bar, but is not more than ¼ mile wide. It runs between the Tusch Gründe and the banks extending southwestward from Seesand. Within buoy E it deepens to 8 to 12 fathoms leading between Seesand and Junge Jap, and is then divided into two channels—one, the Norder Aue, leading to Amrum and Wyk Harbors and Dagebüll; the other, the Süder Aue, leading to the entrance to the Bongsieler Canal at Ockholmer

Koog, is tortuous above Hooge Island. Both the Norder and the Süder Aue are buoyed on the German uniform system.

The Schmal entrance is important for small vessels obliged by stress of weather to look for refuge inside the shallows, where, in Norder Aue, there is good anchorage. It ought only to be attempted by sailing craft with the wind from southwest by south to northwest by west and the weather such that the buoys may be distinctly seen, which is an indispensable condition when standing for this narrow and intricate channel, surrounded as it is by dangerous shoals and breakers.

Seesand is a low white sand bank about 1.3 miles in length, and subject to change. The sea washes over it at high water. It lies 1 mile off the Junge Jap, a flat which dries off nearly 4 miles westward of Hooge Island, and about 3½ miles southward of Amrum on the western side of the entrance. Sand banks, with depths of 1 to 3 fathoms, extend 5 miles southwest of it, with Schmal Deep and Rütergat on either side.

Rüter Gat, which joins the Schmal Deep northward of Seesand, has a least depth on its bar of 1¾ fathoms at low water. Inside the bar the depths are from 4 to 11 fathoms as charted, in a channel about ½ mile wide and nearly straight, which runs in a northeasterly direction between the shoals westward of Seesand. Beyond the light and bell buoy the channel is unbuoyed.

Landmarks.—The principal objects which may be of assistance when approaching Schmal Deep in clear weather are Amrum Lighthouse and the hotel on White Hill Point, south end of Amrum Island, to the north; the lighthouse on Nordmarsch; the beacon on Süderoog Sand; the lighthouse on Westerhever Sand; and on the west side of Pellworm Island there is the old square tower, in ruins, before mentioned, but it is not visible far off, and even in clear weather it is only just seen from the outer edge of the shallows.

Amrum Harbor Light, fixed red, situated 101°, distant 1,968 yards from Amrum Island Light, is exhibited, 26 feet above high water, from an iron hut, striped black and white.

This light in line with Amrum Island Light leads into the harbor, and will be exhibited as long as the navigation is not closed on account of ice.

Two fixed green lantern lights are shown from a wharf near White Hill Point in the approach to the harbor.

Steenodde Light, fixed white, elevated 39 feet above high water and visible 11 miles, is exhibited from an iron framework support, painted white, surmounting a small white house, erected on Steenodde, southeast side of Amrum Island.

Nordmarsch Light, fixed white and red, elevated 43 feet above high water, is exhibited from a brown circular tower, situated on the west end of Nordmarsch Island, east side of the channel abreast Amrum.

Oldenhörn Light, exhibited from an iron beacon on the southeast point of Föhr Island, farther up the opening, is fixed red and green, at an elevation of 39 feet above high water.

Buoys.—The buoyage of Schmal Deep is in accordance with the German uniform system. The fairway buoy is a black and red beacon buoy, with Schmaltief on it, and surmounted by a double ball, in 4 fathoms. Within this buoy, the starboard side of the channel, entering from seaward, is marked by lettered red spar buoys, with ball topmarks, and the port side by numbered black conical buoys, moved as circumstances require.

Rüter Gat—Light buoy.—A light and bell buoy, painted red with " Vortrapp Tief No. 1 " in white letters on it, showing an occulting white light, is moored in a depth of about 7 fathoms, in a position from which Amrum Lighthouse bears 48°, distant 7¾ miles.

The buoy lies 1½ miles westward of the west extremity of the outermost bank, and is probably of use to vessels navigating along the coast. It sometimes breaks adrift, and in winter may be removed on account of ice. In these cases it is replaced by a red spar buoy with a square topmark.

Directions.—It is not advisable to enter Schmal Deep without the assistance of a pilot, unless in case of emergency. Approaching Schmal Deep, the lighthouse on the south end of Amrum Island bearing 17° or Süderoog Beacon 105° leads to the fairway buoy. When coming from the southward the Eider Light Vessel should be sighted and from the northwestward the Amrum Bank Light Vessel. From the latter the fairway buoy bears 112°, distant nearly 15 miles. In thick or hazy weather it will be necessary to pay great attention to the soundings and not get under 6 fathoms until the fairway buoy is sighted.

Pass northward of the buoy and steer about 45° over the bar toward the Alt Schmaltief Red Beacon Buoy (inner end of Old Schmal Deep), leaving the red spar buoys to starboard and the black conical buoys to port. From near the red beacon buoy the course is about 17° to abreast the black beacon buoy at the entrance of Amrum Harbor.

Care is required when passing Seesand, as here the current sets across the channel. Farther inward the navigation to Wyk presents no difficulty. Steenodde and Amrum Island lights in line 253° lead through the channel from abreast Amrumtief Buoy to No. 7 buoy off Oldenhörn.

Amrum Harbor is situated close within the south point of Amrum. At the entrance there is a bar, with 3 feet of water, but across which there is a narrow gut with 5½ feet, and inside 8 feet, until midway, where the depth is shallower. On the south side of the entrance is a black beacon buoy marked "Amrum Hafen" (replaced in winter by a black spar buoy with ball topmark); within the channel is marked by stakes. The harbor affords shelter for small craft against all winds, as the shallows northeast of it dry at half tide.

Range marks.—Amrum Island and Harbor lights in line lead into the harbor. Northward of the harbor entrance is a gray buoy for torpedo boats.

Owing to the extension of shoals at the entrance to this harbor, the rear range light should be kept open northward of the front light when entering.

Pier.—There is a landing pier at Steenodde, at the head of which the depth is 6 feet at low water.

Communication.—Amrum is connected by telegraph with the neighboring islands and the mainland. There is communication by steamer with Föhr Island, Dagebüll, and Husum; also in summer with Sylt, Helgoland, Cuxhaven, and Hamburg. A railroad runs from Wittdün, via Süddorf, Nebel, and Norddorf, to a pier at Kniep Hafen, whence communication with Hörnum is effected.

Anchorage.—Good anchorage will be found in the channel of the Norder Aue, in 6 to 10 fathoms, abreast or northeastward of the entrance to Amrum Harbor, sheltered from all winds except southwest gales, which bring in a heavy sea. In easterly gales better shelter is obtained nearer the Schweinsrücken Sand. Seesand now affords but little shelter against westerly gales. Small vessels with local knowledge may find good shelter in Süder Aue and off Hooge, etc.

Small vessels proceeding from the Norder Aue to the Süder Aue use the narrow channel close westward of Nordmarsch, which has 5 feet at high water, or pass farther westward around Schweinsrücken.

The passage to the Schlütt eastward of Oland is closed by the dam connecting Langeness with Oland and the mainland at Süder Koog.

Lifeboats.—There is a lifeboat station at Amrum Harbor, one on the west point of Amrum Island, and another at Risum, north part of the island.

Amrum Deep, a gutter in the watt between Amrum and Föhr Islands, form a means of communication for small craft between Norder Aue and Vortrapp Deep. It dries in places at low water and is marked by perches on its western side. The southern entrance is marked by a black and the northern by a red beacon buoy, both marked Amrumtief. In winter the southern buoy is replaced by a black spar buoy with ball topmark, and the northern buoy is removed. At about 1,350 yards southward of the northeast point of Amrum is a ford between Amrum and Föhr Islands, very liable to change, available near low water for vehicles and pedestrians. The telegraph cable between Amrum and Föhr Islands crosses the north part of Amrum Deep. The position is marked by beacons on either side.

Föhr Island—Wyk Road.—Föhr, the second largest of the North Frisian Islands, has on its southeastern side the small harbor of Wyk.

In the roadstead off Wyk there is protection for small craft against all winds except those from the south and southwest.

The best anchorage for larger craft is in from 5 to 8 fathoms, with St. Nicholas Church in line with Wyk Mill, at about 1.600 yards southeast of Olderhörn, where the channel is about 600 yards wide.

Wyk Harbor has a depth of about 9 feet at high water. Vessels lie aground on the mud at low water. Approaching from the road, when the entrance to the harbor opens, steer straight in.

Wyk Lights.—Two fixed white lights, 20 and 16 feet above high water and visible 5 miles, are exhibited from wood frames as range lights for entering the harbor.

A fixed light, with white, red, and green sectors, is shown from Wyk Pier.

Storm signals are shown from a mast at Wyk near the landing stage.

Tides.—(For tides at Wyk and Amrum, see General Tide Tables.)

Small craft may be provided with necessaries; water is scarce. There is a shipyard, where small vessels can be repaired.

Wyk is a favorite watering place. There is steamship and telegraphic communication with Dagebüll on the mainland and with other large North Frisian Islands. In addition, during the bathing season, small steamers run regularly to Helgoland, Cuxhaven, and Hamburg.

There are two piers for small steamers to make fast to, but they dry at low water.

There are no loading or unloading appliances.

Coal can always be obtained and will be sent off to craft lying in the roadstead.

Dagebüll, on the mainland, has a small harbor, which is only accessible to small craft and boats on the flood tide.

Dagebüll Lights.—Two fixed white range lights, elevated 23 and 20 feet, respectively, above high water, and visible 9 miles, are shown near the landing pier.

Föhrer Ley is a narrow, shallow channel leading northward through the watt between Föhr Island and the mainland to the eastward. It has a depth of 9 feet at mean high water, connecting the Norder Aue with Hörnum Deep, which latter it enters between the Föhrer Schulter and Horsbüll Steert Sands. The channel is marked on its west side by perches and a beacon at the north and south ends, the approaches to which are partially buoyed.

Vortrapp Deep is entered from the southward on a line nearly parallel to Amrum Island and across the flats fronting that island, where in the buoyed channel there is a low-water depth of about 9 feet. It is protected by the sand banks or flats extending southward from Hörnum Point, described below, and which form its western side.

Both the bar and channel are liable to change.

The continuation inward of Vortrapp Deep from abreast Hörnum Point is Hörnum Deep. It leads northeastward, with a depth of 3¾ to 9 fathoms, along the north edge of Liin Sand; thence toward the coast the depths gradually reduce to the banks, dry at low water, with narrow gullies across them available only for boats or small craft at near high water.

There is another entrance from the westward abreast the west extremity of Amrum Island, known as Jungnamen Loch, with about 8 feet at low water. It is unbuoyed and is subject to change.

Sand banks.—From Hörnum Point sand banks, which dry at low water and in some places at half ebb, project 7½ miles in a 202° direction, forming the west side of Vortrapp Deep. The breadth of these shallows in the middle is nearly 3 miles, the depth gradually increasing seaward. They are named Thee Knobs, Hörnum Knobs, Holt Knobs, and Jungnamen. Between the two latter is Jungnamen Loch, the passage before mentioned for small craft into Vortrapp Deep. Between Hörnum Point and Thee Knobs is a shallow passage from the sea to Vortrapp Deep, sometimes used by fishermen in fine weather. The depth is 3 feet or less in places at low water and changes with every gale.

Beacon.—To distinguish Hörnum Point, the south point of Sylt Island, from the uniform appearance of the adjacent coast, and also to warn seamen of the dangerous shoals which extend southwestward from it, a beacon was erected on one of its sand dunes. The beacon is of a circular form, about 22 feet in height, and its summit is 104 feet above high water. At its base there is a sheltered place for shipwrecked mariners.

The lighthouses on the south end of the island now assist in pointing out its position.

Buoyage.—The new entrance to the Vortrapp Deep, situated to the northwestward of the former entrance, is buoyed as follows:

The fairway distinguishing buoy is a black beacon buoy, marked "Neu Vortrapptief," and surmounted by a cone, point downward, with a ball over. It is moored in 4¼ fathoms, with Amrum Lighthouse bearing 60°, distant 5½ miles.

Within this buoy the starboard side of the channel up to and beyond Hörnum is marked by lettered red spar buoys, A to G, each surmounted by a ball; above letter G Buoy is a red buoy marked "Amrumtief," and 5 miles above is a red and black buoy marked "Nosse." The two latter buoys are removed in winter. The port side of the bar channel is marked by two black conical buoys, marked "1" and "1 A," respectively, the outer one having a diamond-shaped topmark. Eastward of Hörnum is black buoy No. 2, which is removed in winter.

Vortrapptief Light and Bell Buoy 1 is moored 232° 8 miles from Amrum Island Light.

The leading buoy of the former entrance, marked "Vortrapptief," and the black conical buoy No. 1 are still on the chart.

The depths on the bar of the Vortrapp Deep are subject to sudden changes and the buoys are liable to drift from their proper positions.

Anchorage.—The best anchorage under Hörnum is with Hörnum Beacon bearing between 292° and 281°, in 4 to 5 fathoms, 400 or 600 yards from the beach, and sheltered from westerly and northerly winds. The depth decreases rapidly toward the shore. With easterly and southeasterly winds a berth should be taken more to the eastward, under the Liin Sand, the northwest edge of which is marked by three beacons, each surmounted by two cones, points together, as topmark. Gales between south by west and southwest by south render the anchorage unsafe; shelter should then be sought further up Hörnum Deep.

There is a pier at Hörnum with 12 feet of water at its head.

Directions.—Vortrapp Deep is only available for light drafts, and should not be entered at low water, nor at any time by any vessel without a pilot, except in case of emergency. In the latter case the following directions may be found useful, but to proceed beyond Thee Knobs on the western side at night would be risking getting aground.

By day.—Steer for Amrum Island Lighthouse bearing 61° until the Hörnum Range Lighthouses are in line bearing 14°, when they should be steered for, passing close eastward of the Neu Vortrapptief Black Beacon Buoy and between the red and black buoys, taking care to allow for the tidal current setting nearly abeam, until Amrum and Amrum Island Lighthouses on Amrum are in line 143°, when the course should be altered to pass close westward of the red buoys. From abreast Amrumtief Red Beacon Buoy, and with the sand dunes by Rantum Lohe open eastward of the point to the southward of them, bearing about 357°, steer for them to the anchorage.

By night.—Steer toward Amrum Island Light, group flashing white on a 61° bearing, until the Hörnum Range Lights come in line bearing 14° (front light fixed, rear light group flashing); steer for them in line until the middle fixed white sector of light from Amrum Lighthouse changes to red, bearing 156°, when steer 35° until the fixed green sector of light shown from Hörnum Front Light is entered and the fixed red light from Amrum Lighthouse changes to fixed white; hence the line of junction of the latter red and white sectors bearing 178° leads to the anchorage.

Caution.—In an on-shore gale, this inlet, or Schmal Deep, should never be approached by a sailing craft, for from the heavy sea and the cross tidal current, particularly with a northwest gale, it is impossible to come in or out without risking vessel and life. In such a case shelter should be sought in Lister Deep, but if neither that place nor the Elbe can be reached, then the Hever or Eider rivers could be attempted.

Sylt Island—Aspect.—The low sandy island named Sylt presents a nearly straight sea face, 20 miles in length. The southern half is not more than ½ mile in breadth, with sand dunes less than 100 feet in height. The center portion, where are the villages of Keitum, Munkmarsh, Westerland, and Rote Kliff Lighthouse, extends eastward for about 7 miles, which portion is about 2 miles wide, with sand dunes from 50 to 134 feet in height. The wider portion of the north end of the island is known as List Land, and is about 100 feet in height; one hill, the Sand Berg, being 124 feet. The tongue of land forming the north extremity is named Ellenbogen. From the northward List Land appears as three hummocks, equidistant from each other, which are visible about 12 miles. By these hills the island is easily distinguished from Röm, on which the tower of St. Clemens Church is conspicuous.

The western shore consists of white sand dunes, except a single cliff, named Red Cliff, or Rote Kliff, within which is the lighthouse; both afford excellent marks for making Lister Deep. Part of the western shore is protected by groins.

Red Cliff may be discerned at 12 to 16 miles from vessel in 9 to 10 fathoms.

The high red chimney of the electric works ½ mile northward of the church at Westerland is conspicuous, as is also the water tower of that place.

A light railway connects Hörnum, near the south end of Sylt Island, with Westerland. At the Hörnum terminus there is a landing pier, 500 feet long, with a depth of 12 feet at low water at its head. Light railways also connect List and Munkmarsh with Westerland. There is steam communication between Hamburg and Hörnum.

Signal stations—Radio.—There is a signal station at the List lighthouses, north end of Sylt, connected by telegraph with the German telegraph system; and also near Hörnum Beacon on the south end of the island. Vessels communicate by the International Code. At Hörnum, eastward of the signal station, is a radio station. The telegraph office at Hörnum is always open, and that at Westerland in summer.

Lifeboats, etc.—There are six life-saving stations on Sylt Island—namely, at Rantum, a rocket station; at Westerland, a boat and rocket; at Kampen, a rocket; at Ellenbogen, north end of island, a rocket station; at List, a lifeboat; and at Munkmarsh, a lifeboat.

Storm signals are shown near List west lighthouse, at Keitum and at Munkmarsh (day only).

Lights.—The under-mentioned range lights are exhibited on Sylt Island.

Hörnum Odde Lights, south point of island.—Rear light, group flashing white, elevated 157 feet above high water and visible, where not obscured by sand hills, 18 miles, is exhibited from an iron cylindrical structure, painted red, with a white band around its middle section.

An auxiliary fixed white light, elevated 149 feet above high water and visible 18 miles, is exhibited in the same lighthouse.

Front light, fixed white, green, and red, elevated 46 feet above high water, is exhibited from an iron framework support, painted red, with gray lantern, erected on the south end of Hörnum Odde, 194°, 1,600 yards from the rear light.

These two lights in line 14° lead into Vortrapp Deep.

Rote Kliff Lighthouse is a round gray tower, with green dome, 123 feet high, from which is exhibited, at an elevation of 203 feet above high water, a fixed and flashing white light, visible 20 miles. An auxiliary fixed white light, visible 17 miles, is exhibited 5 feet above the main light.

A fixed light with white and red sectors is exhibited, at a height of 77 feet, from an iron tower about 2,400 yards northward of Rote Kliff Light. This light in line with Rote Kliff Light, bearing 175°, indicates the entrance to Lister Deep.

West List Light, on Albue Head, elevated 62 feet above high water, is occulting white, visible 13 miles, and is shown from a white iron circular tower, 31 feet high, with a red top.

A fixed red lantern light, elevated 36 feet above high water and visible 8 miles, is exhibited on a white wooden post, 5 feet high and surmounted by a red triangle, situated about 150 yards northward of West List Light.

East List Light, fixed white, with red sectors, elevated 73 feet above high water and visible 13 miles, is exhibited from a white circular tower, 41 feet high, with red top, situated 98°, about 1½ miles from West List Lighthouse.

A fixed light, with white and red sectors, is exhibited from the tide gauge on the eastern extremity of List.

Röm Island, northeast of Sylt Island, and separated from it by Lister Deep, is 7 miles in length north and south by 2 miles in breadth.

It stands on a sand bank, which under the name of Haff Sand extends 1¼ miles southwest of it and does not cover at high water, and under the names of Juvrer Sand and Römer Flat, 6 miles westward of its north extremity. Eastward, Röm is connected with the main at low water springs by the dry sands.

The dunes in the northern part of the island attain a height of 60 feet at Höst Beacon and 59 feet in the southern part. The villages are situated on the east side. The square tower with pointed roof of St. Clemens Church at Kirkeby is conspicuous from seaward.

Communication with the mainland is maintained in summer by steam vessels between Kongsmark, in the center of the east side of the island, and Scherrebek on the main, and also between Havneby, on the southeast side of the island, and Hoyer; also between Havneby and the ferryhouse near Bodsbüll by means of sailing vessels. Telegraph cables are laid across Lister Deep between the southwest side of Röm Island and the northeast end of Sylt, marked by beacons on either side; also between the east side of Röm and the mainland.

At Kongsmark is situated a wooden jetty about 100 yards long and 12 feet broad.

Lifeboats are stationed at Juvre and Kirkeby.

Storm signals are shown at Kongsmark by day when necessary.

Lister Deep is said to be the safest channel between the Elbe River and Horn Reefs. It has about 15¾ feet at low water springs over its bar, which is situated 3.3 miles westward of West List (Albue Head) Lighthouse and is about ¼ mile wide on the range, but is subject to change. The Water deepens to 6 and 8 fathoms and more within the bar, and all vessels that can cross the bar can reach a fairly good anchorage off List.

Two wrecks are charted in the approach to Lister Deep from the westward. They lie at distances of about 8 and 12 miles, respectively, from West List Lighthouse.

Banks in entrance.—Rüst Sand, a bank of 1¼ fathoms, and Lamb Shoal, with 3 feet of water, are situated on the shallow bank extending westward from the Haff Sand, which forms the north side of the channel between the bar and south end of Röm.

Salz Sand, very shallow and dry in one spot at low water, is situated on the bank forming the south side of the channel between the bar and Albue Head. The sea breaks heavily on these during westerly gales.

Buoys.—The buoyage of Lister Deep is in accordance with the German uniform system.

The fairway buoy is a red and black beacon buoy, with "Lister Tief" on it, surmounted by an elliptical ball with a triangle, point downward, above; it lies in 4½ fathoms about ½ mile westward of the deepest part of the bar.

Within this buoy the channel is marked by lettered red spar buoys with ball topmarks on the starboard side, entering from seaward, and by numbered black conical buoys on the port side. In winter the black conical buoys are removed.

Pilots.—There are no regular pilots. Vessels requiring one should endeavor to avail themselves of the assistance of boatmen or fishermen acquainted with the locality. Persons with a knowledge of Lister Deep and the adjoining channels may be obtained at List and Munkmarsh. Sometimes a pilot may be obtained at Cuxhaven.

Tides.—It is high water, full and change, at Lister Deep Bar Buoy at 1 h. 28 m.; springs rise 6¾ feet. In List Road at 2 h. 14 m.; springs rise 5¼ feet.

Directions.—As Lister Bar is liable to alteration in position and depth, it is advisable, if practicable, for strangers to procure the services of a pilot. The lighthouses on Sylt and St. Clemens Church on Röm are conspicuous objects.

In a sailing craft, with a scant or contrary wind it is necessary, whether inward or outward bound, to pay great attention to the setting of the tidal current, and during the ebb not to come too near Salz Sand or the Rüst, as that current sweeps obliquely across these shoals with considerable strength, but the flood runs from them on both sides of the channel. The rippling on their inner sides is visible, and during boisterous weather from the westward the surf on the shoals indicates the channel. Further in, on the contrary, both flood and ebb run along the Albue Shore, and there, as also midway in the deep, between the Rüst and Salz Sand, it follows the direction of the channel.

Approaching Lister Deep from the southward, keep well off the shoals in depths of not less than 6 fathoms, keeping Rote Kliff Lighthouse bearing eastward of 157° until the fairway buoy is sighted; or, should the buoy be adrift, until so far northward as to have East List Lighthouse between West List Lighthouse and the light post 150 yards to the northward of it, bearing 99°, which mark will lead to the entrance. Approaching from the westward the East and West List lighthouses in line, bearing 98°, lead to the fairway buoy. From the fairway buoy the course is between the red and black buoys until abreast the lighthouses, whence the southern shore is fairly steep-to.

A red spar buoy marks the spit extending off the east extremity of Ellenbogen, north end of Sylt. It is run under sometimes when there is any strength of tide. Having rounded the buoy haul southwestward for List Road, where there is good anchorage.

On the shore at List is a beacon with hourglass topmark, which is useful when choosing a berth for anchoring.

A tide-gauge tower, about 15 feet above high water, surmounted by a mirror, is situated to the eastward of List lifeboat station, about 200 yards from the shore.

Anchorage.—A patch of 3 fathoms at low water lies on the west side of the fairway to List Road after rounding the east end of Ellenbogen. The best anchorage is southwestward of this patch and northward of Hunnigen Sands, in about 6½ fathoms, with West List Lighthouse over the center of Uthörn, an island lying across the entrance to Königs Hafen, bearing 309°. Anchorage may also be had eastward of the patch where the water is deeper, or farther southwestward toward List, where the depths are 7 to 11 fathoms.

Königs Hafen is a shallow bay, the greater part of which dries from 2 to 4 feet at low water.

A mooring buoy for torpedo boats, marked "K M Lister Tief," is moored in List Road.

A red and black beacon buoy, marked "Lister Ley," is moored off the north end of Hunnigen Sands, south side of List Road.

At night, in case of emergency only, when approaching from the southward, and having made Rote Kliff Light, keep outside its red sector, and do not bring the light southward of 157°, or go into less than 6 fathoms, until both the List Lights are in line. The narrow sector of red light shown from the Rote Kliff Lighthouse, bearing from 175° to 166° shows over the bar and the fairway buoy.

The East List Light fixed white, kept midway between the two West List Lights occulting white and fixed red, 99°, leads over the bar, across the red sector from Rote Kliff Lighthouse and northward of the Lister Tief Fairway Buoy. When Rote Kliff Light changes from red to white steer 90° until West List Light is abeam, then alter course to 106° until Rote Kliff Light bears 217°, when the vessel will be abreast Ellenbogen Point Buoy; hence course should be shaped for List Road eastward of the 3-fathom patch. Attention should be paid to the lead and to the set of the tidal currents mentioned above.

Römer Deep is the channel leading from Lister Deep, southward of Röm Island, to the villages on its eastern side. The depths gradually reduce to from 1 to 2½ fathoms off Kirkeby; farther in it dries at low water, and to the northeastward joins the Römer Ley, a staked channel over the sands, connecting with Juvrer Deep.

The channel is marked by red buoys, surmounted by two cones, points together, on the north edge of Jordsands Flat, the starboard side on entering, and a black buoy and perches on Haff Sand, the port side. These buoys are removed during winter.

Small craft may enter the bight at the southeast extremity of Röm at high water but they will be left dry at low water.

Anchorage may be had in the eastern part of Römer Deep sheltered from all winds.

Hoyer Deep is the channel leading southeastward from List Road and Lister Deep, between Jordsands Flat and Hunnigen Sands. On the bar at the entrance the depth is about 4 fathoms; inside the bar for a distance of 4 miles the depths are from 5 to 9 fathoms; they then rapidly decrease. On either side there are shallows, which are steep-to, until past the small island Jordsand. The channel is marked by buoys, the greater number of which are removed during winter.

The sands fronting Hoyer dry off about 4 miles, but there is a staked channel for small craft available at high water, leading to the Hoyer Canal, a straight and narrow channel, with a depth of about 2 feet at low water, formed by dams, and marked by perches. At the inner end is the sluice at the mouth of the Wied River.

Hoyer is connected with the railway system.

Lister Ley is the continuation southward of Lister Deep from List Road, between Hunnigen Sands and the List Shallows. It has depths of 5 to 9 fathoms and affords good anchorage for small craft and shelter from all winds.

Pander Deep is the continuation southward of Lister Ley to Munkmarsh Village, in Sylt. It has depths of not less than 3 fathoms up to within 2 miles of Munkmarsh, whence it gradually shoals to that place. There is a staked channel to the village available for small craft at about high water only. Lister Ley and Pander Deep are both buoyed. Most of the buoys are removed during winter.

Munkmarsh is the landing place for the bathing establishment at Westerland and is the principal loading and discharging place in Sylt Island. It can be reached by vessels drawing 6½ feet of water.

The range lights in line lead to the end of the northern of the two training dams, on which is a spar beacon with ball topmark. A railway connects Munkmarsh and Westerland. There is steam communication with Hoyer and in summer with Röm.

Pilots.—Persons acquainted with the channels may be obtained at List and Munkmarsh.

A staked channel, named Wester Ley, leading in a north and south direction past the Noss, the eastern extremity of Sylt Island, enables very small vessels to pass from Lister Ley to Hörnum Deep at high water.

Hoyer Lights.—A fixed red light is shown from a wooden post at the water gate at Hoyer, at an elevation of 24 feet above high water.

About ½ mile southeastward from the red light a fixed white light is shown, at an elevation of 68 feet, from a latticework mast. These two lights in line lead through the Hoyer Canal.

From a post erected on the dyke, about 220 yards northward of the light on the water gate, is exhibited a fixed green light, elevated 24 feet and visible 9 miles.

Munkmarsh Range Lights, visible 8 miles, are shown from Munkmarsh Harbor. The rear light, fixed white, is elevated 154 feet above high water and is shown from an iron structure 72 feet high. The front light, fixed red, is situated 600 yards 56° from the rear light at an elevation of 66 feet above high water and is shown from a tower 15 feet high. These lights are not shown when traffic is suspended on account of ice.

Rote Kliff Bank lies 13 miles westward of the north end of Röm Island in the northern approach to Lister Deep. It has depths of 3¼ to 4¾ fathoms over coarse yellowish-brown sand on the southern part and fine brown sand on the northern. It is about 5 miles in length northeast and southwest, with an average width of about 1.3 miles. The depths between it and the banks fronting the coast are from 4 to 6 fathoms, and the water deepens gradually seaward, the 10-fathom line being distant between 6 and 7 miles from the western edge of the bank.

Juvrer Deep, 9½ miles north of Lister Deep, leads from the sea between the dry Kore Sands on the north side and Römer Flat and Juvrer Sand, both dry at low water, on the south side and branches off into two channels near the spit of Reisby Shallow.

The bar, nearly 3 miles seaward of Kore Sand, is nearly dry at low water and is only available for small craft at high water. It is unbuoyed and during on-shore gales is not practicable, as it breaks right across. The water deepens to 4 to 8 fathoms in places within the bar, but it is soon swallowed up by the sands extending from 3 to 5 miles off the coast and which dry at low water.

The southern of the two channels just mentioned curves around the north end of Röme Island and, taking a southerly direction, becomes the Römer Ley, a channel across the sands dry at low water and connecting with Römer Deep. The channel is marked by perches on its west side southward of the north end of Röm.

There are only small villages along the coast of no importance in any respect.

Frontier.—The boundary which separates Germany from Denmark is about ½ mile southward of West Vedsted, or about latitude 55° 16′ 45″ N.

Close to the coast here is a beacon, 30 feet high, with a board, diamond shaped, on the top. This beacon, in line with the cathedral at Ribe, marks the boundary line between the Danish and German waters from the eastern boundary beacon on Juvrer Sand and in toward the land.

On Juvrer Sand two beacons mark the boundary between the Danish and German waters in the North Sea.

Draget Deep, between Juvrer and Knude Deep, has about 6 feet of water and connects with the latter eastward of Flakstjerten Sand and northward of Mano Island Sands. It is unbuoyed and only practicable to fishing vessels and such as are intimate with the frequently changing shoals.

This channel has been dredged, and similar regulations for its navigation are in force to those at Thyböron, except that they apply to vessels of more than 10 feet draft.

Knude Deep is liable to constant changes. It lies between Peter Meyers Sand, Kilsand, and lesser banks on the north and Flakstjerten, Mano Flat, and Peel Riff on the south. The bar, which extends about 3 miles westward of Peter Meyers Sand, has about 9 feet at low water in the fairway, deepening to 5 and 7 fathoms within, but above Kilsand it splits up into several shallow gutters, leading to Ribe and other small places on the coast and also northward to Esbjerg, but they are only available for small craft at or near high water.

Beacon.—On the sand dunes at Sönderho on Fanö, north side of the entrance is a pyramidal beacon surmounted by a square with a triangular top and a vane above (like a pigeon house), and is 79 feet above the sea.

Lifeboat.—A lifeboat is stationed at Mano Island.

Buoyage.—The channel is buoyed as far as Peter Meyers Sand on the Danish uniform system, red poles with topmarks, and numbered on starboard side on entering and white poles with topmarks and lettered on port side.

The fairway buoy is in 3 fathoms and is a red and white horizontally striped buoy with ball.

Directions.—Knude Deep should not be entered without local knowledge, except in case of emergency. Approaching from seaward, steer for Sönderho Beacons in line about 56°, which will lead nearly to the fairway buoy.

From the buoy Meyers Beacons will be in line and may be steered for, passing between the first pair of red and white pole buoys; thence southward of Peter Meyers Sand and Kilsand between other buoys.

Ribe Cathedral is visible in clear weather for some miles, and conspicuous by its high square tower, with a flat top.

For such vessels as are able to enter Knude Deep there is good anchorage off Kilsand in about 6 fathoms.

Ribe Channel.—At the southeast point of Kilsand, Ribe Channel branches eastward from Knude Deep, with a depth of 3 fathoms, gradually reducing to a few feet. The gutter beyond only allows small craft drawing 3 to 4 feet to pass up to the town of Ribe, others being obliged to remain nearly 4 miles from the shore, and to unload or load by boats.

At 3½ miles eastward of Kilsand is a canal, 1.8 miles long with 4 feet of water in it, which branches off in a southeasterly direction and joins the Ribe River ¾ mile above its mouth, shortening the distance to Ribe by 1½ miles.

Ribe has about 4,200 inhabitants. The trade is local only, the principal article being hay, which is shipped to the islands.

Tides.—It is high water, full and change, at Sönderho, Fanö, at 1 h. 57 m., springs rise 4½ feet.

Fanö, an island 9 miles in length north and south, with an average width of about 2 miles, lies between Knude Deep and Graa Deep. The sand dunes attain a height of 70 to 74 feet in places.

Sönderho Village is situated at its southeast extremity and Nordby at its northeast extremity.

A telegraph cable to Calais is laid, in a west-southwest direction, from about the center of the west coast of Fanö, as charted.

Fanö is connected with the mainland by a submarine cable extending from ¾ mile north of Nordby to ½ mile north of Esbjerg, the landing place being marked by beacons.

Patent slip.—There is a patent slip at Nordby capable of receiving a vessel of about 60 tons displacement.

Graa Deep Light Vessel formerly marked the approach to Graa Deep, but the approach is now marked by a white light and whistle buoy, showing a flashing white light, moored in (approximately) latitude 55° 20′ N., longitude 8° 05′ E.

Fog signal.—During thick or foggy weather a fog siren is sounded. When out of order a siren worked in the same manner by hand will be substituted.

Graa Deep—Esbjerg Approach.—Graa Deep, the channel between Fanö and Skallingen, leads southeastward to the important port of Esbjerg and to the snug little harbor of Nordby, nearly abreast it; to the northward it leads to Hjerting.

Pilots.—In fine weather a pilot may be obtained outside the bar of Graa Deep. The pilot cutter is then either cruising in the bay or lying at anchor near the light and whistle buoy. By night the pilot signal is shown to approaching vessels. In bad weather, with onshore winds, the pilot cutter lies behind Skallingen, and pilots can only be obtained there.

Pilotage is not compulsory, but in consequence of the changing nature of the sands strangers should not enter Graa Deep without a pilot. The buoys are shifted as soon as possible to meet these changes.

Depth on the bar.—A channel about 200 yards broad, with a depth of 17½ feet at low water and 22½ feet at high water, has been dredged through the bar, on the line of the Saedenstrand Range Lights, but the depth is much affected by the wind; westerly and southwesterly winds raise the level of the water, and easterly winds lower it, but with the latter the bar is always smooth. Within the bar the depths are from 4 to 9 fathoms until near Esbjerg, immediately off which the depths are from 2½ to 3 fathoms at low water.

Strong winds from southwest by south and southwest by west cause a heavy sea and breakers on the bar.

Harbor limits.—These limits are a line from Sandodden Buoy to the red conical buoy off the entrance to Fanö Lo on the north; the lights on the north moles in line to Sandodden Buoy on the northeast; the 2-fathom curve on the west side of the harbor on the west; and the south or detached mole light in line with the west pier of the dock light on the east. At night this means a vessel must anchor eastward of the western green sector and within the white sector of south mole light.

Anchorage.—Vessels can anchor in Graa Deep just inside the bar; also anchorage, out of the way of passing vessels and sheltered from northerly winds, will be found, in 4 to 5 fathoms, between white buoys E and F, within the entrance points. Sheltered anchorage in northwesterly and northerly winds is also found southward of Esbjerg Harbor entrance, eastward of the harbor limits.

Anchorage is prohibited on the range line over the bar and in the sectors of white light shown from Stranby and Sædenstrand Lighthouses; also within the Esbjerg Harbor limits when the harbor is open—that is, in the named fairways. Vessels are prohibited from anchoring between Sandenden and Fovrfeld in the area bounded by the following limits: On the north by Sædenstrand Range Lights in line and on the south by a line drawn in a 214° direction from the entrance to Fovrfeld River.

Skallingen Light, exhibited from a red iron tower, on framework support, 42 feet in height, erected near the south extremity of Skallingen, is fixed, with white, red, and green sectors, elevated 36 feet, and having the white and red lights visible 11 miles, and the green light 10 miles.

The light formerly shown from Skallingenknolde Lighthouse has been discontinued and the lighthouse retained as a daymark. It is a white square tower 69 feet high.

Sædenstrand Range Lights.—For entering Graa Deep, two fixed white lights are shown on Sædenstrand, the front light being visible through an arc of 2° on either side of a 53° bearing.

The western lighthouse (front), 23 feet high, is painted black with white stripes. The light is shown at an elevation of 43 feet above high water and is visible 12 miles.

The eastern lighthouse (rear) is an iron tower 46 feet high, painted red, with a white band, and bears 53° 700 yards from the western one. The light is 86 feet above high water and is visible 15 miles. It is intensified over an arc of 3° on either side of the range line.

A supplementary white, red, and green light, visible 12 miles, is shown from the western lighthouse.

Strandby Beacon exhibits a fixed white, red, and green light, 20 feet above high water, from a brown wooden building at Strandby Beacon, situated 1.3 miles southeastward of the western Sædenstrand Lighthouse. The beacon is a white post with a red and white horizontally striped topmark, model hourglass.

Esbjerg Harbor Range Lights are fixed red, 310 yards apart, on a 123° bearing, and visible through an arc of 6° on either side of that bearing. The northwestern light (front), which is 43 feet above high water and visible 11 miles, is shown from a red standard, surmounted by a triangle, point upward, on the west jetty of the wet dock. The southeastern light (rear) is also shown from a red standard, surmounted by a triangle, point downward, on the eastern jetty, 62 feet above high water and visible 13 miles.

Harbor lights.—A fixed red light, elevated 20 feet above high water, is shown from a white circular tower on the north molehead of the outer fish harbor.

A fixed red and green light, elevated 26 feet above high water, is shown from a white iron beacon standing on the south molehead of the fish harbor (W. mole of Esbjerg New Harbor).

A fixed red light, elevated 30 feet above high water, is shown from a post on the same mole, about 50 yards within its outer extremity.

This light in line with the fixed red light on the north mole of the fish harbor, bearing 115°, leads just south of Sandodden light buoy, but these lights in line do not lead up to the harbor entrance.

A fixed white light is shown from each of the transverse moles at the entrance to the inner fish harbor from July 15 to May 15, annually.

A fixed white and green light is shown from a white beacon on the south or detached molehead.

A fixed red light is shown on each of the outer angles of the lock approach.

Fog signal.—When the fog signal of an approaching vessel is heard, a bell on the south molehead of the fish harbor (west molehead of the new or principal harbor) is sounded.

Rindby Lights.—Two fixed white range lights shown near Rindby, when in line bearing 181° lead through Fanö Lo, the staked channel to Nordby.

Nordby Lights.—A fixed red and white light is shown on Nordby pierhead.

A fixed green, red, and white light is shown on Pakhusbanken, a point ¼ mile below Nordby.

Buoyage.—Graa Deep is marked by a light and whistle buoy in 4¾ fathoms, just southward of the range marks and referred to below.

The bar and the channel to Esbjerg are marked by red conical buoys, two of which are light buoys, numbered 1 to 13 from seaward on the starboard hand on entering, and white buoys, with one or more down-turned brooms as topmarks, together with three light buoys, and lettered A to L, beginning from seaward, on the port hand. They are subject to change.

The eastern edge of the bank extending off the northeastern point of Fanö and northward of the entrance to Fanö Lo, is marked by perches with upturned brooms as topmarks.

Light and whistle buoys.—A red whistle buoy, marked "O," showing an occulting white light, is moored about ½ mile seaward of the bar and a little southward of the line of range lights. A red buoy, marked "III½," showing an occulting white light, is moored westward of Sören Jessens Sand, south side of the fairway. The red buoy marked "VII," moored off the north edge of Sandenden and Jergs Banks, is a whistle buoy and shows a flashing white light.

The white buoy, L, Sandodden, on the edge of that bank, east side of approach to Esbjerg, shows a flashing red light.

When necessary, on account of ice, the light buoys will be replaced by spar buoys, similarly colored and marked.

Landmarks—Beacon.—In making Graa Deep the most conspicuous object is a large square water tower, with pyramidal roof and a turret at each corner, situated in the town of Esbjerg. Blaavand Point and Skallingen lighthouses are also easy to distinguish. Mill Beacon, 60 feet high, stands on the ridge about 1.3 miles eastward of the east point of entrance. It is a pile beacon surmounted by a diamond. It was formerly a bar beacon and is of no use now other than as a landmark.

Tides.—It is high water, full and change, on the bar of Graa Deep about 1 h. 6 m.; springs rise 5 feet; and at Esbjerg at 2 h. 21 m., springs rise 4½ feet, neaps 3 feet.

Outside the bar the flood current sets south-southeast and the ebb current northwest.

On and within the bar the flood current sets fairly through the channel setting inward over the banks on both sides as far as the Torre Bjelke Sand until the time of high water at Esbjerg. The ebb for the first two hours sets straight through the channel and over the banks on both sides; during the next two hours it sets in a westerly direction and during the remainder of the ebb in a southwesterly direction over the bar, turning to the southward outside. The ebb sets out over the bar for some time after low water there. The maximum velocity of the currents at half tide sometimes amounts to 2 knots.

A white light buoy, marked "B," exhibiting a flashing red light every three seconds, is established on Graa Deep Bar, about 100 yards northward of Sædenstrand range line and 1.9 miles 224° from Skallingenknolde (unused) Lighthouse.

A white light buoy, marked "I," exhibiting a flashing red light every three seconds, is established on the western edge of Fovrfeld Sand, 1 mile 275° from Stranby Light Beacon.

Directions.—Approaching Graa Deep from the southward in clear weather, the lighthouse on Sylt Island will enable the vessel's position to be ascertained, and a course shaped for the Graa Deep light and whistle buoy. From the northward and westward the Horns Reef and Vyl light and whistle buoys and Blaavand Point Lighthouse will facilitate the approach. Having passed the Graa Deep light and whistle buoy or the Vyl light and whistle buoy a course should be shaped for the fairway buoys outside the bar.

The land about Graa Deep is low. Approaching the bar the water tower at Esbjerg, the lighthouse on Skallingenknolde, and the Mill Beacon on Fanö on the eastern side of the entrance will probably be the first objects seen, and in clear weather Jærne and Esbjerg churches. The Mill Beacon bearing 73°, or Skallingenknolde (unused) Lighthouse bearing 56°, will lead to the fairway buoys.

In thick weather the Graa Deep light and whistle buoy should be made before shaping a course for the bar, and do not get into less than 6½ fathoms until the buoy is sighted.

To cross the bar bring the two lighthouses at Sædenstrand in line, bearing 53°, and steer for them, passing northward of the whistle buoy; keep this mark on until past No. VII red light buoy off the northwest edge of Sandenden, when alter course to 95°, with Stranby Beacon seen between the church and mill at Jærne. Follow this line until the two red iron standards of the Esbjerg Range Lights come into line 123°, thence between the red buoys and perches on the starboard hand and the white buoys on the port hand to Esbjerg.

Fanö Lo, the channel leading to Nordby, is entered westward of No. XI red buoy and is marked on both sides by perches.

At night entrance is not recommended except in charge of a pilot or of those locally acquainted.

All light buoys which, when entering, have to be left on the starboard hand, exhibit white lights, and those on the port hand red lights.

The 2° ray of fixed white light shown from Skallingen Lighthouse, bearing 47°, passes close northward of Graa Deep light and whistle buoy and of the occulting light buoy O outside the bar, and leads to the line of range lights. (See Light List.)

Or, Sædenstrand lights should be steered for in line, bearing 53° passing northward of the light and whistle buoy, and of the light buoy No. III½, red occulting, and of light buoy No. VII, flashing, the latter of which lies in the green sector of Stranby Beacon Light. Immediately that light is changing to white, steer for it 95°, keeping in the white sector until Esbjerg fixed red range lights are in line, bearing 123°. Then steer for them, until across the red sector of the supplementary light in the Sædenstrand Front Lighthouse, into the white sector. Keep the white sector astern, bearing 341°, until the two red lights on the north moles at Esbjerg are in line, 115°, when the vessel will be about 200 yards northward of Sandodden occulting light buoy; then alter course gradually for Esbjerg Harbor. The last-mentioned two red lights in line do not form a range for the harbor.

If bound to Nordby, alter course for the two range lights near Rindby when they come in line 181° while in the white sector (astern) of the supplementary light at Sædenstrand. These will lead up the staked channel Fanö Lo, available for small craft only, the depth being only about 8 feet at high water.

Signals and regulations.—Vessels proceeding to or from Esbjerg over the Graa Deep Bar, and whose draft necessitates their remaining on the range line or in the white sectors shown from Stranby and Sædenstrand lights, and which can not depart from the range without danger, must make the under-mentioned signals:

By day: N. Z. (International Code) must be hoisted at the foretopmasthead.

By night: Steamers must hoist a red light and a white light 6 and 12 feet, respectively, below the masthead light. Sailing vessels must exhibit a red light on the foremast at least 20 feet above the deck. The above lights are to be of sufficient power to enable them to be seen 2 miles.

A sound signal can also be made by giving, with a foghorn or whistle, four blasts, long blasts and short blasts alternately.

Vessels not making the above signals must give way to those which do, but when vessels, both making the signals, intend proceeding over the bar at the same time in opposite directions, the incoming vessel or vessels must wait until the outgoing vessel has crossed.

The dredgers at work in the channel show a red flag by day, and by night three fixed white lights, two vertically placed on one side, and one on the other. Vessels must pass the dredger on the side from which the red flag and two vertical white lights are shown.

When the dredges are at work on the bar, black beacon buoys will mark the positions of their anchors.

Esbjerg has about 18,000 inhabitants. It is a flourishing commercial town, and is one of the most important export harbors for trade between Jutland and England, with which country there is continuous communication by steamers to the ports of Harwich, Grimsby, and Newcastle.

Trade.—The principal imports are artificial manure, coal, feeding stuffs, and timber; and exports cattle, butter, eggs, and pork.

It is only during very severe winters that the traffic is interrupted by ice.

Harbors.—The harbors of Esbjerg consist of New Harbor, situated within the detached mole or breakwater, and from which Boat Harbor, wet dock, and Eastern Harbor are entered; and the fish harbors westward of it.

New Harbor has a depth of 19 feet at high water in the entrance and within on the western side and at the quays. Eastern Harbor is tidal and dries over the greater part of it excepting the western side along the quay, where for a width of 60 yards the depth is 15 feet at high water. It is proposed to extend the wharfage and to deepen the water alongside.

Boat Harbor, within New Harbor, close to the dock entrance, is small and has a depth of 12 feet at high water.

The fish harbor and its outer harbor have a depth of 18 feet at high water.

The wet dock is triangular in shape, about 13 acres in extent, with a depth of about 19 feet, but the southeast wall has only 13 feet alongside. Three dolphins are placed toward the center of the dock for warping purposes. The entrance is 50 feet wide, with a depth of 18 feet at high water on sill.

There is a somewhat sharp turn to be made just before entering the gates leading to the wet dock, and the tide runs across the entrance. Hawsers should therefore be kept in readiness.

The best time to enter is at high water or within one-half hour afterwards. The dock gates are open from two hours before to two hours after high water.

Around the dock there are cranes capable of lifting from 2 to 15 tons and a movable crane of 20 tons. The railroad runs onto the quays of the wet dock, new, eastern, and fish harbors.

Tugs are available.

Repairs.—The machine shops are capable of repairs to iron vessels and their engines, and there is a shipyard for repairs to wooden vessels. There is a small slip which can take vessels up to 40 tons.

Coal is kept in stock. There are three coal wharves, 500, 400, and 300 feet in length, with depths alongside of 16 to 19 feet.

Supplies.—Provisions are plentiful and good. Water can be obtained from hydrants on the dock walls by obtaining permission from the harbor master.

Lifeboats.—There is a lifeboat at Esbjerg Harbor and also at Svenske Knolde, on Skallingen, about 2.3 miles northward of the entrance, a lifeboat and rocket apparatus near Rindby, 3 miles southward of the entrance to Graa Deep, and a lifeboat at Sonderho, south end of Fano.

Telegraph.—There is telegraphic and telephonic communication between Esbjerg and other places in Denmark, etc., and also with Fano by submarine cables.

Time signal.—Masters of vessels can compare their chronometers at 1 h. 00 m. 00 s., mid-European time, equivalent to noon, Greenwich mean time, at the telegraph office, where a signal is given at that time. The signal consists of a dial and pointer, the latter falling to the extreme right at 00 h. 59 m. and returning sharply to the upright at 1 h. 00 m.

Communication.—There is a regular steamship communication with Grimsby, Harwich, and Hamburg.

Harbor signals.—From the topmast yard of the signal staff on the mole on the western side of the new harbor and about 250 yards within its extremity the following signals affecting the new harbor are shown, as follows:

For New Harbor.—By day: One ball, passenger vessels only may enter; two balls, one under each yardarm, all vessels may enter; absence of signal, entrance prohibited.

By night: Green lanterns in place of the balls.

No vessel may leave the harbor or cast loose from the quay when any of the above signals for admission to the harbor are shown or when one ball by day or a green light at night may be hoisted at the mast on the east end of the south quay of the new harbor.

For the wet dock.—A blue flag hoisted at the upper yard of the signal mast on the western side of the new harbor indicates that the dock gates are open. The gates can not be passed at night.

The depth of water on the dock sill will be shown from the lower yard of the signal mast on the west side of new harbor entrance by means of black squares by day and by red lights at night, the daily high water corresponding to about 18 feet on sill. When the water is more than 5 feet below high water no signal is hoisted.

By night: Red lights are hoisted instead of the black squares.

Storm signals are made at Esbjerg from a mast near the harbor administration office.

When a gale blowing at Blaavand Point, Hanstholm, The Skaw, Fornæs, Giedser, or Hammer Point (Bornholm), the place and force of the wind, according to the Beaufort scale, are indicated by colored flags.

Fano Lo is the channel nearly abreast Esbjerg, leading to Nordby. It has about 8 or 9 feet at high water and is marked by stakes. Red Buoy XI marks the entrance, and Rindby Lights in line led in.

Nordby, on the northeast side of Fano Island, is a small town with about 2,300 inhabitants. There is daily steamboat communication with Esbjerg.

Hjerting Channel leads northward from Graa Deep between Skallingen and Sædenstrand. The actual channel is about 400 yards wide between the sands on either side, which are steep-to, and is marked by red poles with upturned brooms on the eastern side and by poles with crosses on the western side.

The entrance from Graa Deep is between Bojes Bank and Lilho Sand, and has a depth of about 6 fathoms, its west side being marked by the white buoy, letter G. The depths decrease gradually to 2 fathoms off Hjerting.

Light buoy.—A light buoy painted red and marked "Topsand," exhibiting a flashing white light every 15 seconds, is moored on the western side of Topsand, Hjerting Channel. When necessary, on account of ice, this buoy is replaced by a similarly painted and marked spar buoy.

Hjerting is situated on the east side of the channel, nearly 5 miles northward of Esbjerg. Vessels of 9 feet draft may lie afloat at low water; strong southerly winds cause some sea on the ebb. Farther to the northward is Varde Rivulet, admitting craft of 3 to 4 feet draft.

Hjerting is the seaport of Varde, a town with 4,600 inhabitants, and exports a great many cattle and the produce of Jutland to England. It has only 400 inhabitants.

Coast.—From the entrance to Graa Deep the coast trends northwestward to Blaavand Point, off which are the Horn Reefs and inshore channels below described. The coast between is low and sandy and named Skallingen, with sand dunes, from 50 to 22 feet in height, known as Svenske Knolde and Benknolde.

Near Blaavand Point the dunes are higher.

Blaavands Huk Light, exhibited from a white rectangular tower, 128 feet in height, erected on Blaavand Point, at an elevation of 180 feet above high water, is group flashing white, visible 20 miles.

Radio.—A radio station is located at Blaavand Point; call letters O X B.

Storm signals are shown from a yard on the radio mast.

Lifeboat.—Blaavand Point is a lifeboat station. There is a lifeboat and rocket station at Blaavand, southeastward of the point.

Tides.—It is high water, full and change, at Blaavand Point at 1 h. 44 m.; springs rise 7 feet, neaps 5 feet.

Horn Reefs.—These dangerous reefs, steep-to in places, lie in the approach to Esbjerg from the northwestward, and are marked by two light and whistle buoys. The 5-fathom curve seaward of the Horn Reefs is nearly 22 miles west-northwestward, and 11 miles southwestward of Blaavand Point. The main ridge of the Horn Reefs has several sand heads, named the Vovov, with 1¾ fathoms; the Tuxen, and Munk, with 1½ fathoms water; while southeast of these are the Vyl and Cancer Reefs, with 2 fathoms on them. Between the Munk, the east end of the main ridge, and Blaavand Point is Sören Bovberg Knob, with about 1 foot of water only. It divides the Slugen, or Gullet, from the Ringkjöbing Deep.

Buoys.—On the west edge of the Horn Reefs, 4 miles northwest of Vovov, in about 5 fathoms, is a white buoy surmounted by two down-turned brooms. The light and whistle buoy is 5 miles seaward of it.

On the south edge of the Horn Reefs, ½ mile southwestward of the west end of the Vyl Reef, a white buoy surmounted by a down-turned broom is moored in 8 fathoms. These buoys are liable to be washed away.

A red bell buoy, with staff and two upturned brooms as topmark, is established on the northern side of Tuxen Reef.

Horn Reefs Light and Whistle Buoy (lat. 55° 34′ N., long. 7° 19′ E.) is moored off the western side of the reefs in 17½ fathoms, 271° 26½ miles from Blaavands Huk Lighthouse; it is painted white and exhibits a flashing white light every 15 seconds.

This buoy replaces Horn Rev Light Vessel.

Vyl Shoal Light and Whistle Buoy (lat. 55° 24′ N., long. 7° 44′ E.) is moored about 18 miles southeastward of Horn Reef Light and Whistle Buoy and 4½ miles 222° from the west extremity of Vyl Reef in 12 fathoms; it is painted white and exhibits a group flashing white light.

This buoy replaces Vyl Light Vessel.

Tidal currents.—On Horn Reefs, and to the northward and southward, between Nyminde Gab and Skallingen Peninsula, there is a regular tidal current, changing every six hours, though much influenced by the direction and force of the wind.

With gales from northwest by west and north by west, the current of flood sets longer and with greater velocity, and this with southeast by east and south by east gales is likewise the case with the ebb. The flood sets to the southward and the ebb to the northward through the channels across the reef, and generally at a velocity of 1 or 1½ knots. The current follows the trend of the shore, and accordingly to the southward of Blaavand Point the flood sets southeast by south and the ebb northwest by north.

Directions.—When approaching Horn Reefs by day or by night, in clear weather, the light and whistle buoys will enable the mariner to fix his position.

In thick weather a vessel should not stand into less than 17 or 18 fathoms in the neighborhood of the Horn Reefs Light and Whistle Buoy or into less than 9 or 10 in the neighborhood of the Vyl until either of them is picked up. The nature of the bottom is important; if it is gravel, the vessel probably will be close westward or southward of the outer end of Horn Reefs. Particular attention should be paid to the direction of the tidal currents.

Inshore channels—The Slugen or Gullet and its continuation northward, known as the Norman Deep or West Sluge, is the channel between Horn Reefs and the Soren Bovberg Knob.

Its approach from the southward or from outside Graa Deep Fairway Buoy has a least depth of 6 fathoms, and in the channels the depths are from 9 to 14 fathoms. It is very serviceable to coasting craft and is buoyed on the Danish uniform system.

Ringkjobing Deep lies between Soren Bovberg Knob and Ulv Spit, extending from Blaavand Point. The depths in this channel have decreased considerably; it is unbuoyed, and should not be used.

Soren Bovberg Deep, westward of Soren Bovberg Knob, has a least depth of 3¼ fathoms and is marked by buoys in accordance with the Danish uniform system, red on the port hand and white on the starboard hand when proceeding northward from the Slugen.

Slugen and Norman Deep—Buoyage.—The southwest side of the Slugen Channel is marked by two buoys, namely, a red light and whistle buoy, marked " Cancer," showing a flashing white light every 15 seconds, on the northeast extreme of the Cancer Shoals, south side of entrance to the Slugen, and a red buoy, with three upturned brooms, on the eastern extremity of the Munk.

The west side of Norman Deep is marked by a light and whistle buoy, painted in red and white bands, marked " Slugen N.," and exhibiting an occulting white light every 7 seconds.

The buoy is moored in a depth of 12 fathoms at a distance of 10 miles from Blaavands Huk Lighthouse.

The northeastern side of Slugen Channel and Norman Deep is marked as follows:

A white can buoy with three down-turned brooms is moored off the western extremity of the bank extending from Ulv Spit.

A light and whistle buoy, painted in red and white horizontal bands marked "Soren Bovbergs Dyb S.," and showing an occulting red light every 7 seconds, is moored in about 11 fathoms, in the Slugen at the west side of entrance to Soren Bovberg Deep, about 4 miles northwest from the Cancer Light Buoy.

A white can buoy with three down-turned brooms, marked Slugen E., is moored on the western side of a 2¼ fathom shoal, situated about 4 miles northwest of Soren Bovbergs Light Buoy.

A white can buoy with two down-turned brooms, marked "Slugen NE.," is moored on the eastern side of Norman Deep, about 1.3 miles to the northeastward of N. Slugen Light Buoy.

The buoys are liable to be washed away.

When necessary, on account of ice, the light buoys mentioned above are replaced by similarly painted and marked spar buoys.

Wreck.—A wreck lies sunk in the Slugen 0.8 mile 281° from Cancer Light Buoy.

CHAPTER VIII.

HORN REEFS TO THE SKAW OR SKAGEN.

Coast—General remarks.—The coast between Blaavand Huk (Point) and the Skaw is without harbors or refuges other than the Thyborön and which is only available for small craft during fine or moderate weather. Along the coast a bank extends, consisting partly of three ridges, but between Blaavand Huk and Hanstholm of two and in some places of only one ridge, all of very compact sand, with occasional stones, and lying parallel to the coast at nearly equal distances from it and from each other.

The outer ridge is in general distant 600 to 800 yards from the beach, commonly with a depth of 13 fathoms over it. The next ridge, with about 2 fathoms, is 100 to 200 yards in length inside the former, and between them there is a depth of 4 fathoms, and even more.

The few small shipping places there are chosen in the least hazardous parts, where the distance of the ridges from the coast and from each other, together with the depth over the ridges, make embarkation practicable.

The flat-bottomed vessel commonly used on this coast is named a skudder (a kind of smack). During the summer season these skudders anchor inside the ridges and are hauled on shore when boisterous weather renders it necessary.

Aspect.—The coast from Blaavand Huk northward to Nissum Fiord is fairly low, from 70 to 100 feet, excepting Blaabierg, the most conspicuous object on this coast. The churches, having low towers or turrets, are not prominent and are in many cases hidden by the sand dunes seaward of them. Husby Church is lofty, and those on Holmsland to the southward, in the north end of Ringkiobing Fiord, have small pyramidal towers.

Blaabierg, situated 12.5 miles northward of Blaavand Huk and 3.5 miles southeast of Nyminde Gab, is 203 feet in height. From the northward it has the appearance of the roof of a house. From the westward it appears highest in the middle, with hillocks on its southern part, and is more conspicuous at a distance than when near it. From the southwest it appears of an oblong form, with a hillock on its summit.

On the tongue of land separating Ringkiobing Fiord from the sea the dunes at the southern end are sufficiently low to allow of the roofs of Bjerregaard being seen over them. Farther northward they become higher and hide the houses on the inner side.

Beacons.—For the purpose of identifying the several landing and other places between Blaavand Huk Lighthouse and Thyborön, 69 miles apart, large wooden beacons, distinctively painted red and from 40 to 50 feet in height, have been erected close over the coast at the following localities: Ringebjerge, Kjærgaarde, Haurvig, Aargab, Husby Klit, Vœderso, Biergehuse, and Thyboron.

Sketches of these beacons are shown on the chart.

Life-saving stations.—Along the west coast of Jutland, where, from the want of harbors or places of refuge, so many vessels are shipwrecked, lifeboats with rocket apparatus, or separately, have been established at intervals of about 5 miles.

Between Blaavand Huk and Thyborön as follows: Veirs, the southernmost, has both; Hennestrand, rocket apparatus only; Nyminde Gab, both; Bjerregaard, rocket apparatus only; Haurvig, both; S. Lyngvig, both; Sondervig, both; Vœderso, both; Fjand, rocket apparatus only; Thors Minde, both; Tuskiær, both; Ferring, rocket apparatus only; Lilore (Lilleore), both; Flyvholm, both; Thyborön, both.

Nearly all these stations are connected by telephone.

Vejers Bank, small, with a depth of 4½ fathoms and 6 to 8 fathoms around, lies 314°, 10 miles from Blaavand Huk Lighthouse and the same distance from Kjærgaarde Beacon.

Ringkiobing or Stavning Fiord, with depths of 1½ to 2¼ fathoms, is an extensive lake separated from the North Sea by a long, narrow, sandy ridge, named Holmsland Klit, about 20 miles in length, which has been broken through by the waves at different times.

Nyminde Gab, the entrance to this fiord, has shifted considerably to the southward of late years and occasionally is silted up. The depth varies from 3 to 6 feet at high water.

The navigation in this fiord is so tortuous and intricate that local knowledge is necessary, though the different channels are marked out by poles.

Storm signals for fishermen are shown at Nyminde Gab.

Tides.—It is high water, full and change, in Nyminde Gab at 2 h. 45 m.; the average rise is about 2½ feet. Westerly winds cause a greater rise, and with a succession of gales from that quarter a current is continually running in. The contrary is the case when easterly winds prevail.

On the coast between Blaavand Huk and Lyngvig the flood current sets southward and the ebb northward, or in opposite directions to the offing currents. They are much influenced by the winds; with a strong northerly wind and flood tide the velocity of the current may be as much as 4 knots, and the ebb current does not check it perceptibly.

On the coast northward of Lyngvig the flood current sets northward and the ebb southward.

Currents off this part of the coast follow the direction of strong winds. Southerly currents have, as a rule, the greatest velocity, especially when caused by northwesterly gales.

Telegraph.—From the neighborhood of Sondervig a telegraph cable is laid to Newbiggin, England.

The coast—Aspect.—The coast southward of Fialtring (lat. 56° 29′ N.) is low, with sand dunes in places, which hide the houses behind them from seaward. From Fialtring northward to within 5 miles of Thyborön the coast is fertile and of moderate height, with no sand hills. The most conspicuous part of the coast is Bovbierg, 197 feet high, easily distinguished by a pillar on its summit, and by its being so steep toward the sea as to be excavated by it. The low neck of sand dunes north of Thyborön, which separates the North Sea from Lim Fiord, stretches about 4½ miles southward of Agger; and, owing to refraction, the waters of the fiord are sometimes visible from a considerable distance seaward, while the lowlands of the coast is yet below the horizon.

Lyngvig Light, flashing white, elevated 173 feet above high water and visible 19 miles, is exhibited from a white cylindrical tower, 120 feet high, with gray lantern, situated at Lyngvig, on Holmsland Klit.

Nissum Fiord lies between Bovling Church, with a steeple somewhat like that of a mosque, to the northward, and Husby Church, with a steeple and pyramidal gable, to the southward. It is separated from the sea by a narrow sandy ridge, on which are the houses of some of the North Sea fishermen, who are also located on the shores of the fiord, but only about two houses, built together, at Thors Minde, are visible from seaward.

Tides.—Thors Minde, westward of Nissum Fiord. It is high water, full and change, at 3 h. 34 m.; springs rise 2 feet.

Bovbierg Light, on Bovbierg, at about 12 miles southward of Thyborön, is a circular red brick tower, 84 feet high, from which is exhibited, at an elevation of 202 feet above high water, a group occulting white light visible 20 miles.

Signal station.—Bovbierg is an International Code signal station.

Storm signals for fishing vessels are shown at the following places, between Nyminde Gab and Thyborön: Bjerregaard, Aargab, N. Lyngvig, Klegod, Sondervig, Fjand, Thors Minde, Fialtring, Ferring, Veilby, Vrist, Langer Huse, and Knopper.

Lim Fiord, an extensive lake of an irregular figure, insulates the northern portion of Jutland. On its shores, on the route through it, lie the towns Lemvig, Nykiobing, Logstor, Nibe, Aalborg, and which by means of the navigation opened between the North Sea and the Kattegat, partake of the advantage of sea-borne commerce. None but those who have local knowledge should navigate the fiord without a pilot.

Thyborön Channel.—Groins have been constructed around the south point of the entrance; 100 yards eastward of the innermost of these is a wharf, with railway lines connecting with the railway station at Thyborön. This wharf can only be used in fine weather.

On the north side of the entrance the shore is protected by a dyke. About 200 yards southeast from the rear range beacon on this side is a pier, southwestward of which are six dolphins in a depth of 10 feet.

Depths.—In 1915, at high water, there was a depth of 8¾ feet on the bar of Thyborön Channel, 5½ feet in Svanholm Channel, 9 feet in Kobbero Channel, and 7½ feet in Gaaseholm Channel (temporarily closed).

Navigable depths.—The bar of the Thyborön is known as Havrevlen; thence to the entrance points the channel is named Sondre Deep. Within these points the channel divides into three—the northern, named Svanholm Lob and Nordre Dyb or Deep; the central, Langholm Lob, between Langholm and Fiordgrunden; and the southern, Gaaseholm Lob. The latter has been dredged to 7½ feet. The depth is from 3 to 3½ fathoms eastward of the flats and in Nissum Bredening, the first broad. There is apparently not less than 15 feet through the fiord until the Logstor Grund is reached, at the western end of the channel leading to the Kattegat. There is a dredged depth of 12 to 13 feet here, and there is not less water from thence to the Kattegat. In December, 1908, there was a depth of 12 feet at high water on the bar, 10 feet in Langholm Lob, and about 7 feet in Svanholm Lob, subject to change.

A vessel of 8 feet draft can, in fine weather, navigate the channel from the North Sea through Lim Fiord to the Kattegat in charge of a pilot. Within Thyborön there is not less than 12 to 13 feet throughout.

Caution.—Thyborön is constantly changing, and the buoys and beacons are moved as necessary. Some or all of the lights may also be extinguished if the changes render it necessary.

There are nearly always breakers on the bar, except in very fine weather and during easterly winds.

Telephone cable.—A telephone cable crosses the entrance in a southwesterly direction, leaving the north shore southward of the western beacon. Its line of direction is marked by two telegraph poles on each side of the channel. The rear poles are 50 feet high and have sloping supports. The front ones are ordinary telegraph poles, surmounted by a triangle, point upward.

Ice.—In the winter of 1906–7 there was fixed ice from Logstor to beyond Aalborg. In the other parts of Lim Fiord there was much ice, except in Nissum Bredning, which was free of ice. In the Thyborön Channel there is never any fixed ice; drift ice floats in and out.

Thyborön Channel Lights.—Range lights for the use of those acquainted with the fiords are exhibited on the north side of entrance of Thyborön.

The rear light is occulting white, with fixed red and green sectors, 56 feet above high water, and visible 13 miles.

The front light, which is shifted as required, is fixed red, 30 feet above high water, and visible 9 miles, shown from a red wooden movable house with a white band. The lights in line lead over the bar. A white light is occasionally shown from a beacon near the front light.

Gaaseholm Lob Range Lights are shown on the north side of the entrance; the rear light, occulting white, visible 11 miles, near the front bar light. The front light is fixed white.

Thyborontange Range Lights have been established on the south side of Thyborön Channel, as follows:

North light, flashing white, with red and green sectors, elevated 20 feet and having the white light visible 10 miles, the red light 7 miles, and the green light 6 miles.

South light, group occulting white, with red and green sectors, elevated 14 feet and having the white light visible 9 miles, the red light 7 miles, and the green light 6 miles.

These lights are moved and the sectors altered as necessary to suit the fairway. (See Light List.)

Buoyage.—A red and white horizontally striped light and whistle buoy, with ball, and marked "Thyborön" in white letters, showing a flashing white light every three seconds, is moored in 11 fathoms about 3,350 yards 305° from Thyborön Church. Within it the buoyage, chiefly stakes, is on the Danish system and is altered to meet the changes in the channel.

This buoy will be maintained in position from August to the middle of May, and when withdrawn will be replaced by a whistle buoy. It may be withdrawn without notice.

A white light buoy, marked "No. 1," showing a flashing red light every five seconds, is situated about 400 yards northeastward of the north range light on the south side of the channel. A red light buoy, No. 2, showing a flashing green light every five seconds, lies westward of the north entrance to Gaaseholm Lob. The latter is replaced when necessary by a floating beacon with red perch and two brooms.

Light buoy No. 3, a white buoy, showing a flashing red light every five seconds, marks the southern extremity of Gaaseholm Channel.

Beacon.—A red beacon, about 50 feet high, with a long pointed top, is erected as a landmark 1 mile southward of Thyborön.

Thyborön is also a lifeboat and rocket station on south side of entrance, as mentioned on same page, and a lifeboat northward of the entrance.

Anchorage.—There is anchorage in Sondre Deep, abreast the entrance points, in 4 fathoms eastward of the easternmost groin on the south side; also anywhere in the Nissum Bredning.

Landmarks.—When approaching Thyborön from the westward, the first objects to be seen are Vestervig Church, the high land about Kobbero, and Giettrup Mill, on the north side of the entrance; on the south side, the high land about Lemvig, with the churches at N. Nissum, Norlem, and Torring; afterwards, Agger and Thyborön Beacons and the pilot's house.

The pilot station is on the north point of entrance. The pilots will attend when required, when the bar is practicable.

If a pilot can not come out to a vessel while the bar is practicable, a blue flag on a pole will be waved from the front light building to indicate the direction in which the vessel should steer.

Tugs.—There are three tugs; the rate for towage is fixed.

Regulations.—Vessels of greater tonnage than 100 tons or those whose draft of water exceeds 8 feet, whether being towed or not, if obliged to keep in the deeper part of the channel, must indicate this to vessels meeting them by hoisting the signal N Z at the foremasthead by day. At night steamers must under the same circumstances hoist a red light at the foremasthead at least 3 feet beneath the navigational light.

Sailing vessels must show a red light elevated at least 10 feet.

During fog, rain, or thick snow such vessels when in sight of others, both by day and at night, sound four blasts in succession (long, short, long, short) with the steam whistle or foghorn.

Smaller vessels, unable to pass others without risk of collision or running ashore, must indicate the same by this signal.

The above-mentioned signals must remain hoisted or be sounded while the vessel is in the channel, and all other vessels are to keep clear of those carrying them.

The above lights must be visible all around the horizon 2 miles. No vessel may use Thyborön Channel as a stopping place nor anchor in it without urgent necessity.

Dredgers are to be passed at reduced speed and on that side indicated in the daytime by a red flag and at night by two vertical white lights.

A single white light indicates at night the side on which vessels are prohibited from passing, and if passage on either side is temporarily suspended the red flag is not shown by day and one white light is shown on each side at night.

Directions.—If there is no pilot on board, steer across the bar with the two lighthouses in line, attending to the signals which, if possible, will be made from the front light building. Having crossed the bar, the course must be guided by the stakes marking the channel.

A customhouse cutter lies within the entrance on the northern shore.

Tides and tidal currents.—It is high water, full and change, in Thyborön Channel, at 4 h. 9 m., with a rise of 2 feet. During settled weather the current sets in from about three and one-half hours before until nearly four hours after high water, and then sets out until three and a quarter hours before high water. At such times the currents in the channel and outside may be expected to turn about the same time. When an easterly wind sets in after a continuation of westerly gales, the ebb may set out for two or three successive days, until the common water level is settled, when the current again makes regularly. The contrary is the case when westerly winds set in after a continuance of easterly ones.

The velocity of the currents is about 2½ knots, but under peculiar circumstances may run far stronger.

Winds from north, through east, to southeast cause a low water level and a west-going current, which turns southward outside the bar. Winds from south, through west, to northwest cause a high water level and an easterly current, which comes from the southward outside.

Outside.—Close off Thyborön the ebb sets southwestward and the flood northeastward. The flood and ebb currents change regularly in fine weather, but the duration of the flood is about seven and one-half hours and of the ebb about five hours only. The northeast current runs from three and one-half hours before to about four hours after high water. From high water to low water a period of five and three-quarters hours elapse. The southwest-going current runs during the last one and three-quarters hours of the falling tide and the first three and one-quarter hours of the rising tide. Winds between south and west increase the duration of the northeast current considerably, while those between west and north increase the duration of the southwest current.

Ports in the fiord.—A short account of the several small places in the fiord will be given.

For particulars of lights which are exhibited for the local craft, see the Light List, and for the buoyage, see the chart. Only those locally acquainted should navigate the fiord.

Nissum Bredning or Broad, with depths of 18 to 21 feet over the greater portion of it, is the first expanse of the fiord, within Thyborön, its eastern narrow entrance being Odde Sund. The shoals in it are marked by broom beacons in accordance with the Danish system, and will be seen on the plan.

At Krik, situated near the head of the northern arm of Nissum Bredning, there is a pier about 600 feet in length with a depth of 9 feet at its outer end. There is anchorage westward of the pierhead in 8 feet.

Lemvig.—The small town of Lemvig, with 3,200 inhabitants, is situated at the head of an inlet on the south side of the Broad, with the Rönnen and other marked shoals in its approach. A detached mole has been built to protect the harbor. There is a depth of 13 feet at the wharf, and in the dredged channel leading from the fairway of Nissum Bredning to the harbor. This channel, about 2 miles long, is marked by beacons. Pilotage is compulsory for vessels of more than 10 feet draft.

There is anchorage abreast the town, in 9 feet, soft bottom, at 200 to 400 yards from the beach. There is railway communication.

Lemvig Lights.—Fixed red range lights, westward of Lemvig, in line 175°, lead through the dredged channel and westward of the detached mole. These lights are shown from July 15 to May 1, except when the harbor is obstructed by ice. On the east end of the detached mole is a fixed green light. A fixed red light is shown from the harbor pierhead, and a fixed green and red light from the north molehead of the old harbor. Range lights are also shown at Sögaarde and Bierregaard. (See Light List.)

Odde Sund, 600 yards wide, but deep, and steep-to on either side, leads eastward from Nissum Bredning into Kaas Bredning.

Odde Sund is crossed by a steam ferry connecting with the railway.

Venö Sund—Struer.—From Odde Sund a vessel may proceed through Venö Sound, to the shipping place Struer, a town of 2,700 inhabitants, and connected with the railway system. The depth in Venö Sound is about 15 feet, and the shore may be approached by the lead, except on the flat extending from the northwest point of Venö Island, which is rocky. There is a depth of 13 feet in the dredged channel, marked by stakes, leading to Struer.

The anchorage at Struer is 200 to 400 yards from the beach in 9 to 11 feet clear of the dredged channel.

Struer Range Lights, fixed red, in line lead through the dredged channel to that place, and into the harbor. (Shown from September 1 to May 1.)

Venö Bay, eastward of Venö Island, has depths of 16 to 18 feet. Close westward of the rivulet, off Handbjerg, in the southeast corner, craft anchor in 12 feet, at 800 yards from the shore; but northerly winds produce rather a rough sea.

At Hostrup, on the northeast side of the bay, there is a small pier with 4 feet water at its head.

Kaas Bredning, with depths of 3 to 4 fathoms, is approached from the westward by Odde Sund before mentioned. Kaas Head on the south side of entrance should be kept to avoid Jegind Tap Spit.

Vessels may anchor in 12 feet at 400 yards off Aalbaek Mölle or Mill on the southeast shore, clean sandy bottom, but exposed to strong northerly winds.

Harre Vig, eastward from Kaas Bredning, is clean, with a depth of 12 to 18 feet near its head. It is approached through Lysen Bredning, which has a narrow channel toward its northern shore.

Salling Sund, with depths of 5 to 12 fathoms, leads northeastward from Kaas Bredning into the largest broad, the southern portion of which is known as Livo Bredning and the northern as Logstor Bredning. The shore of the sound is fairly steep-to on either side.

Steam ferryboats cross from Glyngore Point, which is reached by the railway, to Nykiobing on Mors Island. The channel to Nykiobing has been dredged to a depth of 13 feet and is marked by beacons. The depth at the wharves is from 9 to 13 feet. The number of inhabitants in Nykiobing is 4,500.

There is a slip at Nykiobing capable of taking a vessel of 200 tons.

Glyngore has two small harbors with depths of 8 and 12 feet in them, respectively.

Glyngore Light, occulating, with white, red, and green sectors, is exhibited from the extremity of Glyngore Point.

Two pairs of range lights are situated at the head of the harbors; the western pair fixed white and the eastern pair fixed red.

Two green lights and one red light are exhibited on the moleheads when the ferry is working.

Vodstrup Light, group occulting, with white, red, and green sectors, is exhibited from a position on the coast about 1,600 yards northeastward of Nykiobing Church.

Fur Light, occulting, with white, red, and green sectors, is exhibited on the north coast of Fur Island.

Nykiobing Lights.—The dredged channel is marked by two fixed red and two fixed white lights, situated northeastward of the harbor.

One red and two green lights are shown when the steam ferry is working.

Orodde Light, fixed white, is exhibited on Orodde; a fog bell is sounded when a steamer is expected.

Current.—With winds from southeast by east, round by east to north by west, the current generally sets to the southward, whereas it sets to the northward through the sound, with the wind from south by east round west to northwest by west, and is frequently too strong to allow a vessel to work through.

Logstor and Livo Brednings, the latter being the name of the southern part, are together about 12 miles in length by 8 miles in breadth. It has depths of about 4 fathoms over a soft bottom; shoals, as charted, those bordering the fairway being marked by stakes.

Anchorages.—Draaby Vig, on the west side of Livo Bredning, affords good anchorage, sheltered against all winds except those from south, which raise a sea in the bay.

Fur Island, 4 miles in length, is situated on the south side of Livo Bredning. Faerker Vig, on the east side of the island, has a clean sandy bottom and a gradually shelving bank, on which small craft may anchor in from 15 to 18 feet and be well sheltered against winds from north by west round by west to south by east.

There is also anchorage in Pulse Vig, Fur Sound, south side of the island, eastward of Degen Point, at 200 to 400 yards from the beach, in 12 feet of water, sand, and mud. Eastward of the anchorage a telegraph cable crosses from Fur Island to Branden, in Salling.

There is a ferry pier in Pulse Vig with 12 feet of water at its head westward of the telegraph cable.

There is a similar pier with 12 feet of water at its head on the opposite side of Fur Sound, near Branden.

Livo.—On the east side of Livo in a small bay there is anchorage in 12 feet at 400 yards from the beach.

Biornsholm Bay, on the eastern side of Livo Bredning, affords anchorage about 400 yards off the rivulet in 9 to 12 feet, sandy bottom.

Risgaarde Bredning is the continuation of Lim Fiord, southeastward from Livo Bredning. It has an average depth of from 5 to 6 fathoms of water, soft bottom. Rotholm, an islet with a reef extending northwest of it, is connected with Salling, the southwestern shore. On the flat to the southward of Risgaarde there is anchorage in 12 feet, sand, at 400 yards from the beach, with deep water southward.

Hvalp Sund, with from 3½ to 13 fathoms, leads from Risgaarde Bredning southward to Skive Fiord and to Lovns Bredning, the banks on either side being steep-to.

The anchorage off Eskiaer is abreast of the stream on the western side of the sound at 200 yards from the beach in from 9 to 12 feet. On both sides of Sundsore Spit small craft may anchor, according to the direction of the wind, in 12 to 15 feet, close to the beach. There is a ferry between Sundsore and the opposite shore of the sound.

Skive Fiord, about 5 miles in length, is the southwestern branch of Lim Fiord, continued from Hvalp Sound. From a depth of 20 feet at the entrance it gradually shoals to its head. The channel leading to Skive Harbor has been dredged to a depth of 13 feet and is marked by beacons. The harbor has the same depth of water. On the bar of the river there is about 2½ feet of water, and within it from 4 to 6 feet up to Skive, a town with a population of 4,600, lying ¾ mile from the shore of the sound. It is connected with the railway system and has steam communication with the towns in Lim Fiord and with Copenhagen.

Lovns Bredning, the eastern arm southward of Hvalp Sound, is about 5 miles in length, with a depth of about 18 feet.

The village of Ulbierg is situated on its southeast side at about 1 mile inland.

Hiarbaek Fiord.—Virk Sund connects Lovns Bredning with Hiarbaek Fiord, the termination of Lim Fiord, in a southeast direction. It has depths of 8 to 18 feet, but the inlets are shallow.

West part of Lim Fiord—Skibsted Fiord and Naes Sund.—The channel leading northwestward from Kaas Bredning, between Jegindo and Mors, has depths of about 14 feet. Its continuation westward is Skibsted Fiord, while the northern is Naes Sund, leading to Visby and thence through Vil Sund to Thisted Bredning.

Visby Bredning or **Broad,** westward of Mors Island, has depths of 21 to 30 feet, decreasing gradually to the shore. A shoal lies in its northern part near the center. Anchorage may be had in 12 to 18 feet, sand, in the southeast part of the broad, off Karby, and also on the western side, off Visby Bro.

Vil Sund leads northward into Thisted Bredning or Broad and has depths of 4½ to 8 fathoms, and both sides are fairly steep-to.

Thisted Bredning.—The depth of this broad is from 5 to 6 fathoms.

Thisted Harbor, with 10 to 15 feet of water, is formed by two moles at the south end of the town. Southwestward of the harbor is a fishery harbor, in which the depth is 7 feet. There is not less than 15 feet, chalk bottom, in the approach.

Thisted Range Lights.—The red light on the new west molehead, in line with another red light north-northwestward of it, leads to the harbor. There is a small green light on the east molehead.

Thisted, situated on the northern shore of the broad, has 6,000 inhabitants. It is connected with the Jutland Railway system by a line to Odde Sund, where there is a steam ferry. There is also communication with the towns on Lim Fiord and with Copenhagen by steamer.

Pilots.—Pilots reside at Thisted.

Fegge Sund unites Thisted and Lögstör Brednings. In its narrowest part, between Feggeklit and Sœbesholm, the channel is only 130 yards wide, but it has a depth of 4 to 11 fathoms, and the banks along either side are steep-to. At the west end at the entrance to Thisted Bredning the depth is 16 feet. A telegraph cable crosses the sound eastward of Sœbesholm.

Lögstör Bredning to eastern entrance Lim Fiord.—From Lögstör Bredning, the largest of the broads in Lim Fiord, a staked channel, narrow in places, leads to Aalborg and thence to Hals at the eastern entrance of the fiord. The shallowest parts through the sand flats, Lögstör Grunde, etc., have been dredged to a least depth of 12 to 13 feet; that through the Lögstör Grunde is not to be depended on. A floating beacon with ball topmark lies off the western entrance, north side of channel. Eastward of Aalborg there is more water.

The western portion of the channel abreast Lögstör and Aggersborg is known as Agger Sund. Abreast Nibe it opens out to a width of about 4 miles, in which are the islands of Öland, Giöl, and Egholm; at the latter it contracts to about 670 yards near Aalborg. The channel, about 9 feet deep, is staked throughout. The bottom consists of loose sand, and consequently the channel is subject to frequent changes, particularly with westerly gales, rendering the services of a pilot indispensable.

The impediment of the Lögstör Grunde bar was met originally by digging the Frederick VII Canal, having in it a depth of 9 feet with a basin at each end with the same depth. The canal begins near and to the west of the town of Lögstör, follows the flat seashore, and ends near and to the south of the Lemdrup Röm Shoal.

Lögstör Range Lights, eastward of Lögstör, lead through the dredged channel over the Lögstör Grunde. The rear light is occulting white, elavated 124 feet, visible 17 miles, and is shown from a red house with white cross on an iron beacon, the whole 52 feet high. The front lights, which are 2,520 yards west of the rear light, are two in number, 22 feet horizontally apart—the northern light red, the southern green—and are shown at an elevation of 33 feet from a white house with gray roof 29 feet in height. The rear light, seen midway between the two front lights, bearing east, leads through the dredged channel. The rear light in line with the green front light indicates the south side, and in line with the red light, the north side of the channel. (See Light List.)

Regulations.—The regulations governing the navigation of the dredged channels at Lögstör and at Agger Sund are the same as those at Thyborön.

Vessels should not anchor on the range lines.

In Lögstör Port there is a depth of 12 feet in the western harbor, 6 feet in the fish harbor, and 8½ feet in the steam ferry harbor. Along the north side of the town there are quays and several places for boats.

A ferry puts Lögstör in communication with Aggersborg. At 2 miles eastward of Lögstör there is another ferry across Agger Sund, where there is a quay for the steam ferryboat, with 7 feet of water.

The water level at Lögstör depends on the wind. Gales may cause the water to fall 4 feet lower and to rise 5 feet higher than the ordinary level. During a continuance of settled weather a regular ebb and flood is perceptible, though the rise of the water is not more than 2 feet.

Pilots can be obtained at Lögstör.

Nibe is situated south of Nibe Bredning, the south part of the broad shallow waters lying between Lögstör and Aalborg. Nibe Bredning has general depths of from 9 to 10 feet of water over an area about 2 miles in extent in the eastern part, but the remainder is shoal. The dredged channel leading to Nibe carries 13 feet and is marked by beacons.

Nibe has regular communication with the towns on Lim Fiord and Copenhagen by steamer. There is also a railroad. The village contains 1,700 inhabitants.

Pilots reside at Nibe.

Aalborg, at what may be considered the eastern end of Lim Fiord, is a city of 32,000 inhabitants, connected with the Kattegat by the Lange Rak, a channel about 15 miles in length, which opens into the Kattegat at Hals by the Haa Dyb.

There are two harbors in which the depth is 14 feet, and depths of 13 to 22 feet alongside the outer quays, which extend the whole length of the town.

At the northwestern part of the town the fiord is crossed by a pontoon bridge, and farther westward by a railroad bridge, both with swing openings.

Pilots reside at Aalborg.

Storm signals are shown.

The coast—Thyborön to Hanstholm—Aspect—Beacons.—The coast between Thyborön and Hanstholm, a distance of 27 miles.

is of the same character as that southward, being composed of sand dunes with but few or any distinguishing features. The hills at Hvidbierg attain a height of 130 feet, and at Jannerup 228 feet, both a few miles inland; some close to the coast reach from 100 to 122 feet in height. Large beacons, in addition to the lighthouses, have been erected on the coast to distinguish the several localities in like manner as southward of Thyborön.

These beacons are from 40 to 45 feet high, painted red, and are situated at the following places: Agger, Stenbierg, Torup, and Klitmöller. The lower part of Agger Beacon is concealed by a dyke 15 feet high.

Life-saving stations.—There is a lifeboat at Thyborön, north side of entrance; a lifeboat and rocket apparatus at Vest Agger; a rocket apparatus at Lyngby; a lifeboat and rocket apparatus at Stenbierg and at North Vorupor; a rocket apparatus at Vangsaa; a lifeboat and rocket apparatus at Orhage (Klitmöller), and also at Hanstholm.

Storm signals for fishing vessels are shown at Agger, Lyngby, Stenbierg, North Vorupor, Vangsaa, Klitmöller (Orhage), and Hanstholm.

Tidal currents.—Flood and ebb currents are regular on the coast in fine weather. The flood sets northward, the ebb southward, but with winds causing a strong current, a change of current seldom takes place. The average rise is about 1 foot. Southwesterly winds cause the highest water level; north and northeast winds the lowest. In southwest gales the water may in exceptional cases rise 6 to 8 feet.

Currents off the coast are dependent on the direction of the wind; southerly and westerly winds cause northerly currents; northerly and easterly winds produce those setting southward; northerly currents are the strongest. The velocity of the current is generally 1½ miles an hour, but near Hanstholm in exceptionally bad weather it may be as much as 4 miles. The southerly current sets somewhat toward the land and the northerly current away from it, particularly between Klitmöller and Hanstholm.

Lodbierg Light, exhibited 6½ miles northward of Thyborön, from a round granite tower, 115 feet in height, at an elevation of 159 feet above high water, is group flashing white, visible 18 miles.

Signal station.—Lodbierg Lighthouse is an International Code signal station.

Nörre Vorupor Lights.—Two fixed white range lights are established at Nörre Vorupor, which, kept in line, lead to the safest landing place; the range is changed to conform to changes in the channel. The rear light, elevated 98 feet above the sea, is exhibited from a red wooden building with a white band, 29 feet high, 200 yards northeast of the storm-signal station.

The front light, 65 feet above high water, is shown from a similar building, 12 feet high, situated 90 yards westward of the rear light; both are visible 8 miles.

A fog bell is rung during thick or foggy weather.

Breakwater.—A breakwater for the purpose of affording shelter to boats when landing is at Vorupor. It begins 200 feet from the shore and extends 1,000 feet in a northwest direction into a depth of 3 fathoms.

Vorupor Breakwater Light, exhibited from a gray framework structure, 28 feet in height, erected on the outer end of the breakwater, at an elevation of 36 feet, is flashing red.

Storm-warning signals are shown when necessary.

Orhage.—At Klitmoller the coast bends to the eastward for ½ mile, forming a point named Orhage.

Klitmoller fishing lights.—At Klitmoller, north side of Orhage, two fixed red lights for the fishermen are exhibited, which kept in line, 47°, lead to the safest landing place. They are visible about 3 miles.

The front light is shifted when necessary.

Jutland Bank, with depths of 10 to 20 fathoms over fine sand and stones, lies westward of the coast just described.

At about 25 miles from the coast, abreast Thyborön, depths of 10 to 13 fathoms will be found over an area about 23 miles long in a northeast and southwest direction, with an average width of 3 miles. On the eastern side of this portion of the bank a narrow tongue of deep water extends southward, with depths of 21 to 28 fathoms.

Wrecks.—A number of wrecks are charted on and westward of this bank and its continuation southward to the Vyl Shoals, at distances varying up to 60 miles from the land, but many wrecks have not been charted and mariners must be always on a lookout for them.

Hanstholm appears from a distance as several hummocks or islands. The remarkable objects on Hanstholm are the church, without turret; the lighthouse; and some farmhouses, named Hedegaarde, to the eastward, in an elevated situation. The extreme north point of Hanstholm is named Roshage, and the hills southeast of it attain a height of 220 feet. The highest of these is the Hiertebierg Hoi. The bottom is rocky for some distance off Roshage. A depth of 5 fathoms lies about 2.8 miles from the lighthouse.

Hanstholm Light, exhibited on Hanstholm from an octagonal white tower 74 feet in height, at an elevation of 213 feet above high water, is group flashing white, visible 21 miles.

Another light, flashing white, is exhibited at a height of 36 feet from a gray structure erected on the outer end of the breakwater.

Fog signal.—During thick or foggy weather the fog signal is sounded.

They will be given alternately from two powerful sirens erected on the edge of the high land, one of which is situated about 600 yards northwest from the lighthouse, the other about 1,700 yards northeast from the lighthouse. The first-named siren will transmit sound strongest in a westerly direction, the other strongest in a northerly direction.

Signal station.—The lighthouse signal station is connected with the Danish telegraph system. Messages will be received and delivered from sunrise to sunset. The signals used are those of the International Code. Vessels showing their numbers will have their names telegraphed (gratis) to the exchange at Copenhagen and Aarhus at noon.

During the ice season signals are made from the signal station as to the withdrawal or replacement of any of the light vessels in the northern part of the Kattegat; also when the light buoys can not be expected to be on their stations.

Breakwater.—At Roshage, northeastward of Hanstholm, a breakwater has been constructed for the purpose of affording sheltered landing for boats. It extends about 1,000 feet northward into 14 feet of water.

Life-saving station.—Hanstholm is a lifeboat and rocket apparatus station.

Hanstholm to Hirshals—Beacons.—For the purpose of distinguishing the several places between Hanstholm and Hirshals, large wooden beacons, painted red, and from 40 to 45 feet in height, have been erected on the coast cliffs at Vigsö, Svinklöv, Blokhus, Kjetterup, and Lökken.

See sketches on charts.

Life-saving stations.—On the same coast lifeboats and rocket apparatus, one or both, are stationed at the following places:

At Vigsö, a rocket apparatus; at Lild Strand, both; Torup Strand, both; Slettestrand, both; Rödehus, a lifeboat; Blokhus, Lökken, and Lonstrup, both; Skallerup Klit, lifeboat; North Tornby, both; and Hirshals (Lilleheden), lifeboat.

Storm signals for fishing vessels are shown when necessary at Bavn in Vigsö Bay, Blokhus, Lökken, Lonstrup, and Tornby.

Vigsö Bay—Bulbierg Bluff.—The coast from Roshage, the north extremity of Hanstholm, which is rocky, trends eastward for nearly 14 miles to Bulbierg, forming Vigsö Bay and affording anchorage in any convenient depth. At 1 mile offshore there is a depth of 4 fathoms. Bulbierg Bluff is 155 feet high and is excavated by the sea. A part of it, the Skarreklit, which is worn away from the cliff, is 52 feet high and lies 80 yards off the bluff. On Bulbierg is a conspicuous hotel, which partially conceals the beacon, between the bearings of 157° and 112°. Southwest of Bulbierg stands Biergat Mill on a hill and surrounded by several houses, and southward of Vigsö Beacon is the remarkable high land of Kaase, steep on its west side and containing some villages and Hiardemaal Church, with its high steeple.

The beach near Bulbierg is known as Lild Strand, as is also a village 2 miles westward.

Bragerne Reef—Buoy.—Bragerne Reef, with from 1 to 6 feet of water, lies about 1½ miles off Sandnaes Hage, the point westward of Bulbierg. A red conical buoy is placed seaward of it in about 6 fathoms.

Jammer Bay is the indentation in the coast between Bulbierg and Hirshals and is 40 miles in length, with general depths of 6 to 8 fathoms over mud and fine sand. The shore is shelving and as little as 5 fathoms is found some 4 miles off it in places.

Lönstrup Rödgrund and Bakken Banks.—In the northern part of Jammer Bay, from 10 to 13 miles westward of Hirshals Point, are two shoal patches, namely, the Rodgrund, 1½ miles in extent with a depth of 3½ fathoms over rocky bottom, situated with Rubjerg Knude Lighthouse 140° nearly 4 miles, and the Bakken, with 4 fathoms, lying with the same lighthouse 106°, distant 5 miles.

Tides.—Between Hanstholm and Hirshals high and low water occur regularly in fine weather; the rise is about 1 foot. Southwest winds cause the highest water level and easterly winds the lowest. The water may rise 8 feet above the ordinary high water and fall 2 feet below the ordinary low water level.

Currents near the coast are due to the wind, and flow along the land eastward or westward. The prevailing current is easterly and runs for about nine months in the year. Its velocity in fine weather is 1 to 1½ knots, but in southwesterly gales may be as much as 3 knots an hour. The easterly current sets toward the coast on the east side of Jammer Bay.

Rubjerg Knude Light, at Rubjerg Knude, northeast side of Jammer Bay, is exhibited from a white rectangular tower 72 feet high, at an elevation of 295 feet above high water; it is a group flashing white light, visible 23 miles.

Fog signal.—During thick or foggy weather the fog siren is sounded.

Hirshals Point separates Jammer and Tannis Bays, protruding some 4 miles from the line of coast on either side of it. On either side of Hirshals the depths are irregular and the bottom foul. Depths of 4 fathoms will be found at from about 1 to 1½ miles off the point. To the westward the 10-fathom curve is about 6 miles off, with patches of 6 fathoms and less within that distance.

A wreck is charted 6 miles 247° of the lighthouse; northwestward of it in about 10 fathoms is a conical buoy with ball topmark.

There are numerous wrecks in the southern and southeastern part of the North Sea and comparatively few are marked.

At about 3 miles northeastward of the point the bank fronting the shore extends 1½ miles off, at which distance the depth is 2¼ fathoms, with 5 fathoms at ½ mile beyond.

Caution.—A prudent distance for a vessel of deep draft to pass Hirshals Point is about 10 miles, but wrecks are charted 14 miles off Hanstholm Lighthouse and off the middle of Jammer Bay.

Aspect.—Besides the lighthouse and signal station the other remarkable objects on the shore near Hirshals are Loibjerg, a hill of moderate height, flat on its upper part, on which stands Horne Church and Mill, and the high land of Rubjerg, with its lighthouse, distant 10 miles southwestward of the point. Among the sand dunes on the shore, the Svinklov, 9 miles eastward of Bulbierg, on the south shore of Jammer Bay, is one of the most remarkable, being high, steep, and flat on the top, on which there is a beacon.

Hirshals Light, on Hirshals Point, is a circular tower of a grayish color, 115 feet in height, from which is exhibited, at an elevation of 187 feet above high water, a fixed and flashing white light, varied by a white flash, visible seaward 20 miles.

On the northwest side of the structure a surface 18 feet square is painted white for displaying ice signals.

Fog signals.—During thick and foggy weather the fog siren situated 124 feet northwest of the lighthouse is sounded.

Absence of light vessels.—Signals relating to the absence of the light vessels in the Kattegat are made from the lighthouse and from a mast with a yard, situated westward of the lighthouse, similar to those at the Skaw. Further information may be obtained by exchanging signals with the semaphore.

At night information regarding the light vessels is conveyed by means of an auxiliary light.

Ice signals will first be shown when navigation is closed for sailing vessels.

Previously to this time mariners must draw their own conclusions as to the conditions of the ice from the signals made showing the absence of the light vessel and light buoys from their stations.

Signals relating to ice in the several ports or navigable channels are shown by means of black squares on the white surface on the northwest face of the lighthouse as at the Skaw.

Telegraph.—The lighthouse at Hirshals is connected with the general telegraph system and also with the adjacent life-saving stations.

A semaphore signal station, in connection with the telegraph station, is erected 50 yards eastward of the lighthouse, where messages are received and dispatched from sunrise to sunset. Vessels which show their distinguishing signal on passing will be reported at noon at the exchange in Copenhagen and Aarhus without charge.

Lloyd's.—The signal station is in connection with Lloyd's.

Storm signals for fishing vessels are made at Hirshals (Lilleheden).

A pier extends northward from Hirshals 295 yards, having at its outer end a depth of 18 feet. A little outside the pier the depth is 14 to 16 feet. The south end of the stonework is connected with the shore by a bridge of open pile work. The pier is intended to provide sheltered landing for boats. It is 5 feet above high water and in the center is a tide-gauge house.

Telegraph cables.—A telegraph cable connects Hirshals with Arendal, in Norway, and with Newbiggin, on the northeast coast of England.

Tides.—It is high water, full and change, at Hirshals Point at 4 h. 28 m., and at the Skaw at 5 h. 56 m., but the rise and fall is only about 1 foot.

Hirshals Point to the Skaw—Beacons.—For the purpose of distinguishing the coast, large red wooden beacons from 40 to 45 feet in height are erected at places on the coast cliffs, as follows: Tversted, Kandesteder, Spirbakken, and Old Skagen.

Life-saving stations.—There is a lifeboat at Uggerby; a lifeboat and rocket apparatus at Tversted; a lifeboat at Skiveren; a lifeboat and rocket apparatus at Kandesteder; a lifeboat at Spirbakken and Hoien West; and lifeboat and rocket stations at Old Skagen and the Skaw.

Tannis Bay.—Between Hirshals Point and the Skaw is Tannis Bay, where good shelter will be found with southeast and southerly winds.

A vessel may anchor on the Skaw Bank, a sandy bank extending 7 miles from the shore in 8 to 10 fathoms. Abreast Old Skagen there are depths of 10 to 12 fathoms at 1½ miles from the shore over sandy bottom.

Wrecks.—Several wrecks are charted in the vicinity of and on the Skaw Bank.

Current.—High and low water occur regularly on the coast, but there is no change of current. Winds between south by west and northwest by west give the highest and those between northeast by north and east by north the lowest water level. The water may rise 6 feet above and fall 3 feet below the ordinary high and low water levels, respectively.

Off Tannis Bay there is usually a current setting in a northeast by east direction, except during easterly gales, when it occasionally runs to the westward. Along the shore of the bay the set is with the wind. The easterly current runs for about nine months in the year with a velocity of ½ to 1½ knots.

Skaw approach—Hoien Light, on the northwest side of the Skaw, is exhibited from a white tower 45 feet in height, with a white building at its base, at an elevation of 46 feet above high water; it is group flashing white, visible 12 miles.

The fog signal is made by two sirens, situated northward of the lighthouse. These in thick or foggy weather are sounded alternately.

One siren sounds loudest in a north direction; the other sounds strongest in a west-southwest direction.

Old Skagen village is situated near the shore, 1 mile southwest from Hoien Lighthouse.

The Skaw, or Skagen, the low and sandy northeastern point of Jutland, at the junction of the North Sea with the Kattegat in the route to the Baltic, is the turning point of one of the principal highroads of commerce and is passed during each year by a very large number of vessels. On the south side and 2 miles westward of the point stands the town of the same name, with a population of about 2,400, and in direct railway communication with Frederikshaven. Close northeastward of it is the old Skagen Lighthouse.

Skagen Light, exhibited from the circular gray tower, 152 feet in height, with a large white patch on its north face below the gallery, erected about ½ mile within the extremity of the Skaw, at an elevation of 144 feet above the sea, is flashing white, visible 18 miles.

Telegraph.—The lighthouse is connected with the general telegraph system of the country and with the adjacent life-saving stations.

Signal station.—Vessels can communicate with the signal station just eastward of the lighthouse by the International Code. The station is connected with the general telegraph system, and messages are exchanged with passing vessels between sunrise and sunset.

A hotel on the north shore obscures the view from the station between the bearings of 11° and 354° from it. Vessels must therefore keep their signal flags flying until the signal station is clear of the buildings in order that they may see distinctly if their signal is answered.

At night signals may be sent by means of lights, using the Morse Code.

Telegraph cable.—A telegraph cable is laid from the Skaw to Marstrand, in Sweden. Two beacons, painted red and white, erected on the shore near the old lighthouse, mark the position of the shore end and when in line, the 112° direction at first taken by the cable.

Ice signals.—When the state of the ice in the Kattegat is such as to impede navigation, signals are shown by means of black tablets on the white painted square on the lighthouse, and when light vessels, buoys, etc., have to be removed, day signals are made from the top of the old lighthouse and night signals from an auxiliary light station on the northern side of the Skagen Lighthouse.

Wind signals.—A wind semaphore has been established near the lighthouse. The semaphore consists of a latticework structure 96 feet in height, with a horizontal yard pointing north and south. The mast is fitted with six arms on each side to denote the force of the wind at Hanstholm and Anholt, the letters H and A being placed above the yard on the north and south sides, respectively, to indicate that the signals made on those sides refer to those places. The direction of the wind is indicated by a vertical disk provided with a pointer placed on each quarter of the yard facing to the eastward.

On the north yardarm is placed an Ø and on the south a V, to assist in reading the direction of the wind when seen from behind (the westward), Ø signifying Øst or East and V signifying Vest or West.

Storm signals in accordance with the Danish uniform system are made from the yardarms of the semaphore.

The red night signal lights are screened from the bearing of 190°, through south, to 123°, to avoid confusion with the auxiliary light on the north side of the lighthouse.

Pilots.—At the Skaw pilots may be obtained either to bring vessels to an anchor or to conduct them to Skagen Harbor, Hirsholm, Frederikshaven Road, The Sound, and Great and Little belts.

A pilot steamer has been stationed near the Skaw. She is named the Skagerrack, is painted dark green, has two masts and a yellow funnel, and has "Dansk Lods" (Danish pilot) marked on her sides.

The vessel supplies pilots for The Sound, the Great and Little belts, and for the harbors on the east coast of Jutland. A pilot to Skagen Harbor may also be obtained.

A Swedish pilot boat provides pilots for the neighboring coast of Sweden, as well as for Arendal, in Norway.

Skagens Rev Light Vessel, painted red with a white cross, has main and jigger masts, a red ball on the mainmast, "Skagens Rev" on her sides, and lies in 20 fathoms of water northeastward of the end of the spit, with the Skagen Lighthouse bearing 236°, distant

8½ miles. From the vessel is exhibited a flashing red light, visible 11 miles.

Caution.—Passing vessels should give the light vessel a wide berth, as, on account of the strong current which prevails at times, the danger of collision is thereby prevented. Should, however, a vessel pass close to the light vessel she should pass astern of her.

Fog signal.—During thick and foggy weather a fog siren is sounded.

Skaw Spit.—The narrow neck of land between the Skagen Lighthouse and the extreme point is named the Grenen, and consists of compact hard sand. From the point a spit extends 2 miles 56° within a depth of 3 fathoms, steep-to on all sides, and over which the sea breaks in stormy weather. It consists of a hard white sand, with stones in places, ballast thrown there from stranded vessels.

During the day the edge of the spit is distinguished from aloft by the discoloration of the water.

On the southern side of Skaw Spit the depth increases gradually, so that the soundings are a good guide. The northern side is steep-to and should not be approached within a depth of 13 fathoms, from which it shoals suddenly to 4 fathoms.

Buoys.—A red conical buoy surmounted by three upturned brooms is placed off the northeast extremity of Skaw Spit in 13½ fathoms. A red buoy with two upturned brooms in 4¼ fathoms marks the southeast side of Grenen Spit, the southern part of Skaw Spit.

These remain in their places until carried away by the ice, when others are as soon as possible substituted for them.

Lifeboat.—A lifeboat is stationed at Grenen Spit.

Anchorage.—With westerly and southwesterly winds temporary shelter will be found southeastward of the Skaw in 8 or 9 fathoms, sandy bottom, with the old lighthouse bearing about 337°.

Current and ice.—From a summary of several years' observations of the currents on board the Skagens Rev Light Vessel the following may be expected with, or after, winds from the quarters mentioned:

With westerly winds, an easterly current, with velocities of from 1 knot to 4 knots, but a north or northeast current, probably weak, may be experienced with these winds, and if the wind is from the northwest by west, a southeast by east set may be found.

With southeast by east winds, an easterly, northeasterly, or northerly current may be expected; the latter usually strong if the wind is strong.

With northeast by north winds, a current setting between northeast by north and north by west generally weak, but sometimes attaining a velocity of 2 knots, may be anticipated.

With long continued easterly winds, a northwest current, probably weak, may be experienced.

During calms, weaker currents are probable, but are not to be depended on, as an easterly set attaining a velocity of 2½ knots may be found.

In easterly gales during winter the ice is piled up on that part of the spit where there is less than 1 fathom of water, and sometimes remains for a long time after the rest of the ice is gone.

Skagen Havn, situated about 1¾ miles southwest by west of Skagen Lighthouse, is formed by two breakwaters, which extend in a southeast direction for about 550 yards from the coast, their ends curving together but leaving an entrance between them nearly 200 feet wide.

Within the havn a pier extends parallel to the coast for a distance of 350 yards from the southwestern breakwater toward a short pier from the opposite breakwater, with an entrance between about 130 feet wide leading into an inner havn.

Depths.—The depth in the outer entrance is 3¼ fathoms and in the outer portion of the havn 2¼ fathoms. There is from 1¾ to 2 fathoms of water in the inner havn and the piers have a depth of 1¼ fathoms alongside.

Pilots for Skagen may be obtained from the pilot steamer at the Skaw or at the havn.

Storm signals.—Storm signals are made from the health office on the south breakwater at Skagen.

Current.—The current sets generally to the northeastward outside the havn.

Skagen.—The town of Skagen, founded in the fourteenth century, contains low dwellings, built with crossbeams and surrounded by tarred-plank palings, not laid out in streets, but built in the most sheltered positions under cover of sand dunes to protect them from the drifting sand. It is a favorite sea-bathing place, with a population of 2,936 in 1906, and has hotels.

Communication.—A railroad runs to Frederikshavn, a distance of 25 miles and there are post, telegraph, and telephone offices.

Supplies of provisions and water may be obtained.

Repairs to motor boats are made at a workshop.

Life-saving station.—A lifeboat and rocket apparatus are stationed at Skagen.

Skagen Harbor Lights.—(*a*) Outer southwest mole: An occulting red light, eclipsed at short intervals, elevated 19 feet above high water, and visible 5 miles, is exhibited from a gray cylindrical tower, 23 feet high, erected on the molehead. A hand foghorn is sounded during thick or foggy weather; bad weather may prevent this signal from being given. (See Light List.)

(*b*) Outer northeast mole: A fixed green light, elevated 29 feet above high water, and visible 3 miles, is exhibited from a gray cylindrical tower, 23 feet high, erected on the molehead.

(*c*) Inner west mole: A fixed red light, elevated 20 feet above high water, is exhibited from a post erected on the molehead.

(*d*) Inner east mole: A fixed green light, elevated 20 feet above high water, is exhibited from a post erected on the molehead.

The above lights (*c*) and (*d*) are only visible over the harbor.

(*e*) **Signals prohibiting entry and exit.**—A black ball by day or two vertical green lights, 4 feet apart, by night denote that entry into the inner harbor is prohibited. Two black balls by day or one white light, 4 feet vertically above a green light by night, indicate that exit from the inner harbor is prohibited. These signals are made from the eastern molehead of the inner harbor.

Water.—Fresh water can be obtained for drinking and also for boilers.

Sailors' home.—A sailors' home and the customhouse are situated near Skagen Harbor.

APPENDIX.

Particulars of dry docks, patent slips, etc.

[NOTE.—It is probable that new docks have been built and older ones extended since the beginning of the war, but data is not available.]

Port.	Name of dock.	Length.		Breadth of entrance.	Depth at M.H.W.S.		Lifting power.	Date built.	Remarks.
		On blocks.	Over all.		On sill.	On blocks.			
		Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Tons.*		
Flushing	Dock	244	244	52	13	13	....	1896	
Middelburg	Prins Hendrik	413	413½	65½	15	....	....	....	
Ghent	No. 1	426½	446	42⅔	17⅝	....	....	1892	
	No. 2	248⅔	255	36	14½	....	....	....	
Antwerp	No. 1	502	542	78	22¼	23	....	....	
	No. 2	220	229	39⅓	13	....	....	....	
	No. 3	151	159	32¾	8¾	....	....	....	
	Nos. 4, 5, 6	425	450	49	17	17	....	....	
	New	685⅔	703	89⅔	29⅛	29⅛	....	....	Building. An extra 60⅔ feet will be obtainable with caisson in outer stop.
	Cockerill	372	400	41	17½	15	....	....	
	Cales et Chantiers	300	330	40	14	....	....	....	
	Cales et Chantiers, No. 2	280	300	36	13	....	....	....	
Hellevoetsluis	Government	477⅓	500	53¾	18½	....	....	1883	Can be divided into two parts, 239 and 231 feet long.
Rotterdam	City, No. 1	....	157	68¾	....	20	2,000	1883	Nos. 1, 2, and 3 can be united as one dock.
	City, No. 2	....	295	68¾	....	20	4,000	1893	
	City, No. 3	....	360¾	68¾	....	21	6,000	1904	
	City, No. 4	....	556	95–86½	20	25	15,000	1906	
	Prins Hendrik, No. 1	300	301	55	20	17	3,000	1903	
	Prins Hendrik, No. 2	436	438	79	24	21	7,500	1903	
	Wilton's	424	424	70	22¾	18¾	8,000	1907	
	do	....	340	62	....	22	4,200	....	
	Patent slip, No. 1	170	....	....	....	....	1,200	....	
	Patent slip, No. 2	300	....	....	....	[1] 12½ [2] 26½	3,000	....	
Ymuiden	Government	....	164	34⅓	21¼	....	650	....	
Amsterdam	Wilhelmina	....	424⅓	73½	....	20	7,500	1899	
	Koninginne	....	402	63⅓	17⅛	....	4,000	1879	
	Koning	....	402	56	15	....	3,000	1880	
	Juliana	....	615	80	....	21	16,000	1911	

[1] Forward.

[2] Aft.

Particulars of dry docks, patent slips, etc.—Continued.

Port.	Name of dock.	Length.		Breadth of entrance.	Depth at M.H.W.S.		Lifting power.	Date built.	Remarks.
		On blocks.	Over all.		On sill.	On blocks.			
		Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Tons.*		
Amsterdam	Maatschappij, No. 1		210	62½	13¼				
	Maatschappij, No. 2		165	62½	13¼				
	Maatschappij, No. 3		165	62½	12¾				
Willemsoord	Government, No. 1	357		62½	20				
	Government, No. 2	262	264	59	17				
	Government, floating		131	21½			200		
Harlingen	Patent slip	[1] 164				[2] 8½ [3] 8½	270		
Emden	Floating, No. 1		284½	59	17¾		3,200		
	Floating, No. 2		314	59	17		3,000		
	Patent slip (Cassino)		120			7½			
	Patent slip, Government		150			15			
Wilhelmshaven	Government, No. 1	410	428	70	28	26½		1872	
	Government, No. 2	410	428	70	28	25½		1872	
	Government, No. 3	361	377	61½	23½	20½		1871	
	Government No. 4	565	585	101½	37¾	32		1906	
	Government No. 5	565	590	101½	37¾	32			
	Government No. 6	565	590	101½	37¾	32			
	Floating, No. 1		407	79½	17¾	14½			
	Floating No. 2		346	66½	17½	14½			
	Floating, new						40,000	1914	
	Floating T. B., No. 1		269	77			1,400		
	Floating T. B., No. 2		269	77			1,400		
Bremerhaven	Kaiser	741½	754½	98½	34½	34½		1899	
	Norddeutscher Lloyd's	453 373	459 379	56½	21	21			
	City dock	858⅓ [4] 878⅝	869 [4] 889½	132	38	38		1913	
	Seebeck's, No. 2	550	550	65		21			
	Seebeck's, No. 3	210 175	210 175	45	17	16			
	Seebeck's, No. 4	 240	550 240	72	20	19			
	Seebeck's, No. 5	268 190	290 205	51	17	16			
Geestemünde	Tecklenborgs	363½ 230	369¾ 235⅝	45½	15			1856	
	Wasserbau	346 180	350 183	40½	15				

Brake	Thyen		343	41	13			1876	
Bremen	Weser, No. 1		134½	46	18	13⅛	3,300	1885	These two docks can be used in conjunction.
	Weser, No. 2		196	49	18			1890	
	Weser, No. 3		483⅓	83	27	23	12,000	1911	
Brunsbüttel	Otto Doose	180½	180½	29½	8⅛				
Hamburg	Blohm & Voss, floating, No. 1		325	52	21⅓	18	3,000		In 3 sections.
	Blohm & Voss, floating, No. 2		350	60½	21⅓	18	4,700		Do.
	Blohm & Voss, floating, No. 3		560	88	32	28	17,000		
	Blohm & Voss, floating, No. 4		590	111		28	17,500		
	Blohm & Voss, floating, No. 5		730	132	36	30	46,000		
	Vulcan, floating, No. 1		434	70		18	6,000	1898	
	Vulcan, floating, No. 2	505	510	82	24		11,000		
	Vulcan, floating, No. 3		525[4]	108½	33	33¼	25,000		
	Vulcan, floating, No. 4		605½	118			17,500	1913	In 2 sections.
	Reiherstieg, floating, No. 1		340	64	20	19	5,000	1888	
	Reiherstieg, floating, No. 2		508	76	22	22	11,000	1912	
	Reiherstieg, floating, No. 3		511	97		26	20,000	1912	In 3 sections.
	Wiehorst Dry Dock		400	50	18				
	Brandenburg, floating		467½	64	19½	19	7,000	1891	In 5 sections.
	Stulcken, floating, No. 1		282⅓	60	16		3,500		In 2 sections.
	Stulcken, floating, No. 2		175½	60	16		2,100		
	Stulcken, floating, No. 3		306	64	18½		5,700		Do.
	Wencke, dry		260	50	14				
	Patent slip, No. 1	[1] 240				[2] 8 [3] 13			
	Patent slip, No. 2	160				[2] 10 [3] 20			
	Patent slip, No. 3	120				[2] 6 [3] 11			
	Patent slip, No. 4	120				[2] 6 [3] 14			
Altona	Rode's, floating		150	41	17	10½	600		

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[1] Cradle.
[2] Forward.
[3] Aft.
[4] With caisson in outer stop.

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